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Smelting at Panulcillo, Chile

SPECIAL CORRESPONDENCE

SYNOPSIS—An account of the smelting operations of the Central Chili Copper Co. at Panulcillo in the province of Coquimbo. Besides the ore of its Panulcillo mine, the company smelts custom ores, for which a bedding system is provided. An unusual charge-track arrangement is employed.

The Central Chili Copper Co. was the outcome of the reorganization of the Panulcillo Copper Co., which began operations about 50 years ago at Panulcillo, in the province of Coquimbo, Chile. The company is owned by French and English capital and is under the management of Berthold Schiff, a native of France, who has had a wide experience in Mexico and Latin-American countries. The mining operations are in charge of Charles Gibbons, and the smelting plant is under the direction of Thomas F. Higgins, formerly with the United States Smelting Co., at Midvale, Utah, assisted by R. L. Lee, formerly with Mason Valley Mines Co., of Thompson, Nev.

GENERAL VIEW OF CENTRAL CHILI COPPER CO. AT PANULCILLO

WORKS IN CENTER OF COQUIMBO ORE DISTRICT

The smelting plant of the Central Chili Copper Co. is situated in the center of the Coquimbo ore district, being 78 km. from the port of Coquimbo and 42 km. from Ovalle. On account of its central location, the plant is able to secure ores from all the surrounding districts without incurring a heavy freight rate. There are two other smelting plants in the district, but they do little or no custom smelting.

The Central Chili Copper Co.'s plant is at an elevation of 1,200 ft. above the sea, out of the zone of heavy rains, and below that of snow or freezing weather. Consequently, little housing of the plant is necessary. The present furnace of the Herreshoff type has a capacity of about 250 tons a day, and was installed by H. K. Masters in 1907, replacing three old-style furnaces.

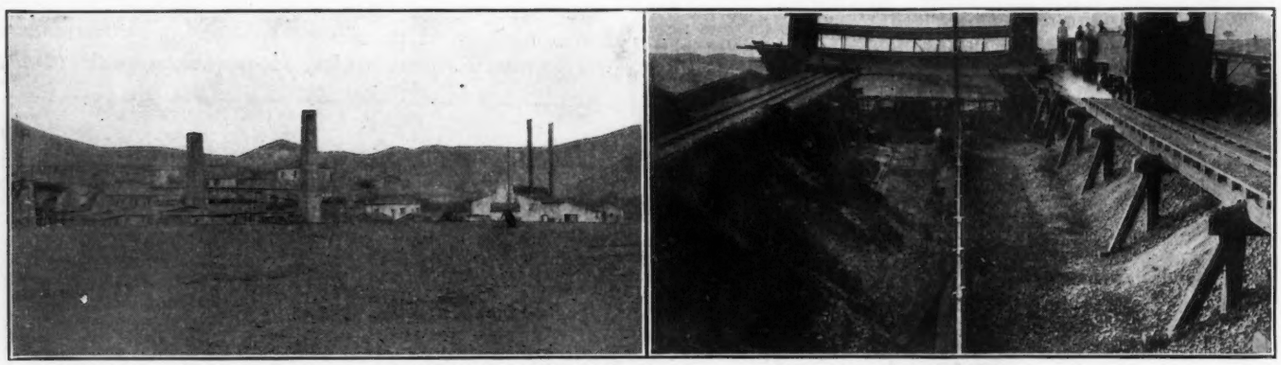
CUSTOM ORES ARE BEDDED

The company operates the famous Panulcillo mine, situated about 2 km. from the smelting plant. A little more than 50% of the ore smelted is from this mine. The remainder of the charge is made up of purchased ores, carbonates and oxides, from various parts of the district, and as they are of a wide variety, a bedding system is necessary. The *Journal* of May 15, 1915, published an illustration of the beds made at the Central Chili Copper Co.'s plant by dumping the ore sacks brought in by burro troop. As this system was modernized some time ago, a description of the bedding system now in use may be of interest.

The Panulcillo mine is connected with the smelting plant by a gravity incline, and the ore is brought down in 3-ton bottom-dump cars. While about 2% of the custom ores still arrives on burros and is dumped to the pile direct, the other 98% arrives in railroad cars, mostly of 20 tons' capacity, having flat bottoms. In one of the accompanying illustrations the bedding system is shown with two trestles, 125 ft. long. These are 12 ft. higher than the feed-floor level and have a track for the charge cars which run along either side.

When the custom ores arrive at the plant, they are shoveled over the side of the car, commencing at one end of the trestle and moving forward as the unloading proceeds, so as to give an even layer from the contents of each car. As the ore falls on the apex of the bed and rolls to either side, a fair mixture is obtained. From the two trestles four beds of 900 tons each can be made. This storage capacity, about 3,600 tons, is ample for this plant.

The sampling of the ores is done in a primitive way, but it is the method used in most parts of Chile and seems to give satisfaction both to buyer and to seller. As the ore is unloaded from the cars, every 20th shovelful is taken for a sample. This is passed through a Sturtevant jaw crusher and then over a divider, after which it is quartered and bucked in the usual manner. Owing to the great number of different ores arriving each day, it is almost impossible to get an analysis of all the ore placed on a bed before it is smelted. In making up the furnace charge, the percentage of iron and sulphur in the bed is taken into consideration, since by knowing these two factors the metallurgist accustomed to the ores of the district is able to judge of the proportions of the furnace mixture. Any alteration that may be required can be made as soon as the slag has been examined. Once the bed or mixture is adjusted to produce the right slag, there is seldom any need to change the charge until the next bed is opened.



TWO VIEWS OF THE SMELTING PLANT AT PANULCILLO, PROVINCE OF COQUIMBO, CHILE

Coke is bought in England and shipped in sailing vessels, the voyage from England to Coquimbo taking about one hundred days. Before the war German coke was used. Arriving in Coquimbo, the coke is unloaded on stockpiles. Because of the uncertain arrival of the ships it is necessary to carry a large stock of coke at all times. Shipment from stockpile at Coquimbo is made in 7-ton railroad cars as needed for the furnace. The coke is unloaded at the smelting plant in a manner similar to that for ore, the space provided for coke having a capacity of 300 to 400 tons, thus compensating for any irregularity in the arrival of the coke trains.

Transfer Car and "Change Track" Permit Use of Charge-Car Tracks Without Curves

In handling the furnace-charge cars an unusual method is used. By installing a "change track" and a transfer car, all curves in the charge tracks were eliminated. The ore beds, the sulphide ores and the coke piles are all made parallel to the axis of the furnace. The so-called change track, 200 ft. long, runs at right angles and is 2 ft. lower than the charge track. On the change track runs a flat car, the top of which is on a level with the rails of the charge-car tracks.

Side-dump charge cars of 2½ tons' capacity are used for the ores and smaller cars of the same type for the coke. The coke and ores are shoveled into the cars from the floor of their respective beds. After filling, the cars are pushed out to the change track, run on the flat, or transfer, car and then to charge tracks on either side of the furnace. The charge cars pass over scales on the way to the furnace, are weighed and run to the charge doors. At first thought, this appears to be an expensive method of handling charges, but when the cheapness of labor is taken into consideration, it is not found to be expensive. The cost of taking ore from the beds to the furnace is less than 4c. per ton.

Sow Difficulties in the Blast Furnace

The blast furnace at the Central Chili Copper Co.'s plant measures 46x144 in. at the tuyeres and has a height of 9 ft. There are four jackets on each side and one jacket at the ends. The side jackets have three tuyeres each. A copper breast jacket is used, and a water-jacketed steel spout, with water-cooled copper nose-piece, traps the blast 5 in. All jackets, as well as the spouts, are made at the plant. The copper breast jackets and nose-pieces were formerly purchased in New York. Lately, however, a small reverberatory furnace, 2 ft. wide and 4 ft. long, has been constructed, and in this the old breast jackets and scrap copper are melted and the copper poured into the molds for the new breast jackets and nose-pieces.

The bottom of the blast furnace is lined with silica brick, but on account of difficulties with iron "sows," the problem is to prevent the bottom from becoming too high rather than from burning out. In the two years' run on the present bottom there has not been one break-out in the bottom of the furnace.

The forehearth is 8 ft. in width and 15 ft. in length and is made of ¼-in. steel, lined with crushed siliceous ore, the bottom being of slag brick. When necessary the settler is cooled by a water spray, but the latter is sometimes not used for several days. Owing to accumulations of iron sow, the bottom of the settler gradually builds up and it becomes necessary to raise the tap hole from time to time. After a run of 30 to 40 days it is usually necessary to change settlers. This is done by breaking the joints on each side, where the sheets are put together with bolts instead of rivets. The frame is then taken

away in pieces and the sow raised with jacks in order to permit it to be taken out on rollers. Changing the settler necessitates shutting down the furnace for two days, during which time any necessary repairs are made. Small forehearths of the type formerly used at Trail, B. C., were tried, but it was found that sow difficulties were greater with the small settler than with the large one. The settler sow, when cooled, is blasted, broken into pieces small enough to enter the furnace doors and resmelted at times when the furnace is in good condition. The smelting of the sow in small quantities does not seem to make any increase of sow in the settler. The sow usually contains about 40% Fe and 40% Cu.

The Slag Is High in Alumina

About 7,000 tons of ore are smelted per month, and an average slag analysis is as follows: SiO_2 40.9%; Fe 15.6; CaO 12.3; Al_2O_3 22.8; MgO 1.1; Cu 0.43%. The slag is hauled to the dump in small hand-tilted pots drawn by mules or horses. It is under consideration, however, to replace the animals with mechanical traction. The matte is tapped from the settler into cast-steel molds, each mold holding about 300 lb. of matte. When cooled it is passed through a Blake crusher and put into sacks containing about 220 lb. each and shipped to New York. The grade of the matte is maintained as near 50% as possible, as this grade has been found most economical.

Flue dust was previously wet and fed back to the furnace while running under low blast. Recently an Empress briquetting machine has been installed, and in the future the flue dust will be briquetted with some of the finer ores which contain sufficient talcose material to act as a binder.

The power-house equipment comprises two Garrett compound engines of 225 hp. each, running at a speed of 187 r.p.m., direct-connected to three-phase generators. Only one engine is run at a time, the other being kept in reserve in case of breakdown, or to give time for cleaning the boilers. The power is distributed through different motors about the plant, there being a 60-hp. motor for the matte crusher, a 15-hp. motor for each of two pumps and another of the same size for the sampling mill, an 80-hp. motor for the briquetting plant, and a 100-hp. motor for the furnace blower. The blower is a No. 7 Connersville and delivers air to the furnace at a pressure of 20 oz.

The smelting plant is operated in 12-hr. shifts and, including the mechanical department, employs about 200 men. The men are paid from 2½ to 4½ pesos per day, except the mechanics, who receive from 4½ to 8 pesos. As the Chilean peso has a value of about 18c., U. S. Cy., according to the present rate of exchange, hand labor is in most cases cheaper than mechanical operations. Therefore much of the work is done by hand.

When labor is cheap one is usually inclined to think that it is inefficient. On the contrary, some of the men at this plant are excellent workers, and as a whole one might compare them to the Greek laborers used in some of the plants in the western part of the United States. As an example of the efficiency of these workers, it may be mentioned that a gang at Panulcillo unloads 20 tons of ore per man for a day's work, and the charge wheelers will load and put to the furnace 20 tons per man per day. Yard men working by task will do as much as the average workman of this class in the United States. As for mechanics, one may encounter much worse in the States.

In closing, it may be of interest to mention that the Central Chili Copper Co. was one of the few mining or smelting establishments of Chile that withstood the general crisis in 1914 and worked without interruption after the outbreak of the European war.

TRANSPORTING MOLTEN SLAG AND "CLEANUP" AT THE PANULCILLO PLANT

Slag is hauled from the blast furnace by animals at present. The substitution of mechanical traction has been under consideration for some time, but up to date no installation has been made.

Method of elevating "cleanup" to the furnace-feed floor. The "angarillas" hold about 250 lb. each. Because of the cheap labor and the small quantity of material to be handled, an elevator is not installed.

Asphalt in the United States

Since 1907 the output of manufactured asphalt from domestic sources has dominated the asphalt industry of the United States, says the United States Geological Survey. The quantity of manufactured asphalt from domestic petroleum reached 360,383 tons in 1914, with another 313,787 tons produced from Mexican petroleum, as against a total production of natural asphalt of 77,588 tons. This latter was subdivided as follows: Bituminous rock, 48,771 tons; wurtzilite (elaterite) and gilsonite, 19,148; and grahamite, 9,669 tons. This was produced by the states of California, Kentucky, Oklahoma and Utah. Although ozokerite occurs in Utah, the United States has for years imported practically all its supply from Galicia.

Production of Precious Stones in the United States in 1914 amounted to $124,651, according to the Geological Survey. Of this, $60,932 was in sapphires; $13,370 in turquoise and matrix; $8,312 in agate, chalcedony, onyx, etc.; $7,980 in tourmaline; and the remainder of the production scattering.

The Second Pan-American Scientific Congress

On Oct. 23 the preliminary arrangements were completed for the most comprehensive international conference that has ever been held in the United States. From Dec. 27, 1915, to Jan. 8, 1916, there will meet in Washington, D. C., the Second Pan-American Scientific Congress, in which all of the American republics will participate and for which preparations have been going on for nearly two years.

According to the official reports, each of the 21 American republics will appoint delegations composed of its leading educators, economists, engineers, international lawyers, and experts on mining, agriculture, health, transportation and finance. From present indications it is estimated that there will be in attendance over 150 of the most representative men of Central and South America.

The first congress was held in Santiago, the capital of Chile, in 1908. That was attended by hundreds of the leading scientists of the Americas, including a large delegation from the United States. When it adjourned, it unanimously agreed to hold the second in Washington. The United States Government has therefore appropriated $50,000 for the expenses of the conference, and the President of the United States was authorized by Congress to invite all the other American governments to participate. The authority for the preliminary arrangements was placed in the hands of the Secretary of State, who in turn appointed an executive committee to make all preparations for the congress. This committee consists of:

William Phillips, Third Assistant Secretary of State and chairman ex-officio.

James Brown Scott, secretary of the Carnegie Endowment for International Peace, vice-chairman.

William H. Welch, president of National Academy of Sciences, honorary vice-chairman.

John Barrett, director-general of the Pan-American Union and secretary-general of the committee.

W. H. Bixby, brigadier-general, U. S. A., retired.

Philander P. Claxton, Commissioner of Education.

William C. Gorgas, surgeon-general, U. S. A.

William H. Holmes, head curator of Smithsonian Institution.

Hennen Jennings, former president of London Institution of Mining and Metallurgy.

George M. Rommel, chief, Animal Husbandry Division, Bureau of Animal Industry, Department of Agriculture.

L. S. Rowe, president of American Academy of Political and Social Science.

Robert S. Woodward, president of Carnegie Institution, of Washington.

The president of the congress will be Eduardo Suárez-Mujica, Ambassador of Chile.

The Drills

By Berton Braley

Hear the clamor of the drills
As they bark,
As they batter the foundations
Of the everlasting hills
In the dimly lighted dark,
And the loud reverberations
Fill the murky stopes with sound,
Waking echoes underground!

Oh, there's music to the drills,
And it thrills,
For the clamor as they hammer
And they batter on the rock
Is a song of brave endeavor
And of hope and progress too.
For the drills are drilling ever,
Making dreams come true!

Hear the ringing, swinging measure
Of the drills
As they dig for buried treasure
Underneath the mighty hills;
How they shout in joyous mirth
In the caverns of the earth!

How they clatter as they shatter
All the locks that guard the ore;
And their song grows ever louder
As they bore, bore, bore,
Making ready for the powder [der
Which shall wrench the rocks asun-
With a sound of muffled thunder,
With a deep and mighty roar.

In the deepest nooks and niches
Go the drills,
Reaching for the hidden riches
And the buried wealth that fills
Nature's treasure houses deep.
So the gold that misers heap,
And the silver and the lead
And the copper rich and red—
They are all the fruit of toiling
Of the drills;
They are plunder from the spoiling
Of the hills;

So the heart of man beats faster
And his every fiber thrills
To the song that makes him master
Of the treasure of the hills,
To the yammer and the hammer
And the wild barbaric clamor
And the unrelenting war song
Of the drills.

Motor-Truck Ore Hauling in California

Motor-truck freighting in competition with the railroad in southern California is reported as failing to be as successful as was anticipated. The men who engaged in motor-truck freighting in direct competition with the railroad are said to have created the impression that the steam and the electric railways would in a short time be supplanted as freight carriers by motor trucks. This is one of the wild dreams indulged by automobile manufacturers and drivers; but it is one of the most painful ones from which to awaken.

The motor truck has a place in southern California and especially on the desert and in the mining districts, not so much in competition as in connection with railroad freight transportation. The actual competition of the motor-truck freighter is with the mule and the horse. There are places, of course, where the automobile has difficulty in climbing the hills, but these places are few and good road construction would reduce them to an inconsiderable minimum. Automobiles are being used very extensively for carrying express and parcel post, not only in southern but in northern California as well; but comparatively little of this is in competition with the steam and the electric railway lines. In the heavy freighting by motor trucks there is practically no competition with railways, but in the suburbs and between the smaller towns, the automobile has made heavy inroads on the passenger traffic of the railroads, more particularly the steam railroad. So far as the motor stage is concerned, whose chief competition is with the horses and mules, the advancement or failure of this method of heavy transportation in the mining districts will depend upon the improvement of the automobile to meet the requirements of the desert and mountain roads. Large amounts of parcel-post and express matter, and in some instances articles of weight and bulk, are hauled in the small cars built for passenger purposes and not in any respect adapted to the carrying of even light freight.

The automobile manufacturers seem to have given more attention to the carrying of passengers in the mining districts than to the hauling of freight. There is a demand for light freight automobiles in various districts, in addition to practical passenger cars.

Cost of Mine Openings*

SYNOPSIS—The cost of opening ground for mining development has never been standardized, and there is a wide difference of opinion as to the real value of work intended to serve as assessment on claims. Facts and figures are given in this article, and standardizations made which may serve as a guide to similar work.

A large part of the early development work on most mining properties consists of surface excavations such as opencuts, trenches, shallow shafts and short tunnels. Of this work the greater portion may be classed as the annual labor performed on unpatented claims. This assessment work entails the expenditure of large sums each year throughout the mining regions of the West. Its unit cost of course varies greatly under the peculiar conditions applicable to particular localities. There is, however, a much greater difference in the cost of mining work in separated regions as depth is reached.

Costs for Excavations by Hand

During the last four years in the Northwest, in inspecting about $500,000 worth of surface prospect work, I have taken advantage of many opportunities to collect authentic cost data along this line. The figures given here are all for handwork. In the specific cases to which references are made an average efficiency of the labor was obtained. With a higher efficiency, undoubtedly much lower costs could be shown in some cases.

The performance of assessment work is not taken seriously by a great many people, particularly when the owner does the work himself, not with a view to the real development of the ground, but merely to hold it. In such cases it is only natural to expect that the amount of work will be stinted. Men usually apportion to themselves higher wages than they could obtain elsewhere, and in addition work short hours. Where owners hire the work done, no matter for what purpose the ground is held, they aim to get full value for the money expended.

There is a sort of tradition among many miners and claim owners that all assessment work is worth $10 per foot and that the United States Government will allow that valuation for the work when passing on claims for patent. This is not the case, however, as the law pertaining to the statutory expenditure on a claim is very specific as to the value of the work required, and no mention is made of feet or yardage. When a full $100 has not been expended as annual labor on an unpatented claim, it is subject to adverse location, no matter how many feet of work have been done. Accordingly, it behooves every owner of unpatented mining property to acquaint himself with the reasonable value of work performed upon his claims, so that he may be in a position to protect himself from a charge of abandonment for failure to do the requisite amount of assessment work.

Quite often among non-mining-claim owners, and even among some mining men, there is a misconception of the actual cost of surface mining work. A miner, on completing work on a mining claim, will generally report so many feet of tunnel run, or of shaft sunk, for a certain amount of money expended. To a man who has no way of knowing the cost of surface work, this reported cost may sound reasonable, but not to a man of experience in this line. As an instance: A miner, who had been hired by a claim owner to do the annual labor, reported a 10-ft. shaft sunk for the $100. The owner, who remembered reading mining companies' reports of shafts that cost from $40 to $150 per foot, considered he was receiving his money's worth; while, as a matter of fact, the miner should in this case have sunk four 10-ft. shafts for the $100.

Throughout the country great numbers of unpatented mining claims which show promise, and in which the owners have faith, are held by business and professional men who, in having the annual assessment work performed, want every dollar to count in the way of developing the ground. Usually, men are employed on a daily-wage basis to do this work, nearly always unsupervised. It is difficult to get full returns for the money thus paid for unsupervised labor, but a great many claim owners insist on getting fair returns and take steps to insure good results by making it clear to the miners that they are not going on a picnic, and by checking up the work as often as possible.

There is no doubt that, ordinarily, greater efficiency can be obtained from men working under direct supervision, as in a city trench, than working without it in some remote place. This does not, however, necessarily mean that the unit of a large operation carried on by fully supervised labor can be conducted more cheaply than can the small job performed by unsupervised workmen. This is attributable to the absence of all overhead and depreciation charges such as large contractors have to carry. Quite often, where only a few men are working, there is no overhead expense whatever to charge against the cost of the work.

Another thing to keep in mind is the correct number of men to be put on a job to get the best results. In this respect there are other things to consider besides the placing of the men with a view of working to the best advantage. A case has been brought to my attention where two men were sent out to a camp in the hills to do the annual labor on two lode claims. After the completion of the work on the first claim, a third man was sent out to help finish the job. In checking up the results, it was found that more work was done for the $100 on the first claim than on the second, under identical working conditions. The mystery was finally solved when it occurred to the owner that "slough" is a three-hand game.

Relation Between Wage Scale and Total Cost

Increased cost of work naturally results where higher wages are paid and the working day is shorter, but the resulting increase is seldom as much as the price per hour per man would appear to indicate. Men working an 8-hr. day will generally do a greater amount of work per hour than those working a 10-hr. day. It was noticed in places underground that when an 8-hr., instead of a 10-hr., schedule was put into effect practically the same amount of work was accomplished in the shorter shift.

*Read by E. D. Gardner before the Montana Society of Engineers, Butte, Mont., Apr. 10, 1913.

Better work may be expected, other conditions being equal, from miners in a $4 camp than from those in a $3 one. The mines paying the higher wages naturally have a larger number of men from which to choose their workers. As a rule, high-priced men are more effcient than those receiving smaller wages. As an example: On a rush job miners at $3.25 per 8-hr. day were put to work to help finish an excavation on which a Greek section crew were working at $1.75 per 10-hr. day. The cost per cubic yard of the work done by the miners was a little less than that done by the section crew. This is of course an exceptional case, and allowance must be made for cost per hour of labor.

Places where surface excavations are made are generally in the outskirts of the main districts or in places remote from centers of population, where it is necessary for the men either to go some distance to work or live at a camp. Generally, the more efficient men are not obtainable to do this work at the standard scale of wages for the locality. Such jobs are usually relatively short and have other obvious disadvantages, to offset which it is often customary to pay $0.25 or $0.50 per shift more than the standard scale.

It sometimes occurs, though seldom, that a shaft or tunnel is started at the surface where the rock is unaltered and may be as difficult to excavate as at depth. Ordinarily the work is in rock affected by weathering and decomposition. In most mining districts the sedimentary rocks are shattered and softer at the surface. The igneous rocks also have the same tendency toward disintegration, particularly in the vicinity of veins. Exposed rock is seldom as hard as that found at depth.

The Cubic-Yard Basis for Openwork

The simplest forms of development work are opencuts and trenches. Later, when the location of the lead is determined, shafts may be sunk or, if the contour of the ground is favorable, adits opened.

In computing costs, opencuts and trenches are calculated on a cubic-yard basis and shafts and tunnels by the linear foot, due allowance being made for the size of the cross-sections. A good method of arriving at the cost of shaft is to figure the first 7 ft. as an opencut on a cubic-yard basis, and from there down as a shaft at so much per foot in depth. Material can be readily thrown with a shovel from a depth of 7 ft. To do so from a greater depth increases the cost per cubic yard, and where a windlass is to be installed in any event, it is not economy. It is common practice in city trenches, and to some extent in shafts where no greater depth is desired, to throw material from a depth of 8 or 9 ft. to the surface. Shafts are often sunk to a depth of 15 ft. or more without installing a windlass, the material excavated being thrown to the surface by means of benches. The broken rock is thrown from the bottom to a bench and from there to the surface.

The cost per cubic yard of opencuts varies from $0.50 to several dollars; prospect tunnels, from $2.50 to $30 per ft.; and prospect shafts, from $4 to $40 per ft. depending upon the conditions. The cross-sections of such tunnels and shafts are generally 4x6 ft.

At Butte, with miners' wages $3.50 per 8-hr. shift, the cost of opencut work averages about $1 per cu.yd. The formation is a quartz monzonite, locally known as the Butte granite. This rock, with the exception of unaltered boulders and an occasional ledge of solid granite which outcrops, decomposes at the surface and to quite a depth in the proximity of veins. The boulders are mainly at the surface, but are frequently found below and in veins at depth. There is almost an entire absence of any angular slide overburden. At points where the granite is well disintegrated, the cost of opencut work will be less than $1 per cu.yd. On the other hand, where boulders are encountered and in ledges of solid granite the cost will be considerably higher. Excavations in this district are nearly always started in the decomposed granite. There is not much object in starting them in hard rock as no vein outcrops are found in the unaltered portions. The altered granite near the surface is mostly picking ground, and little blasting is required in openwork.

The cost of short tunnels from the surface at Butte runs from $3 to $8 per ft., except some work on the main range in hard aplite, which costs over $10 per ft. In the majority of cases involving decomposed granite, the cost is between $4 and $5 per ft. This includes cutting the timber standing on the claim or near-by and placing it in the tunnel, but not its purchase price or the expense of bringing it from a distance. Generally, where the rock is soft enough to require timbering, the greater ease with which it is broken will compensate for the extra labor of cutting timber and putting in sets. Where the tunnels run into spiling ground and into hard boulders, the cost will of course be increased. These figures do not refer to tunnels of large cross-section in the solid granite in the deep mines.

The cost per ft. of sinking prospect shafts in the Butte granite depends on the amount of decomposition of the rock and on the depth of the shaft. Prospect shafts are generally about 4 ft. wide and 6 ft. long, as this makes a convenient-sized excavation in which one man may work. The average cost of a 4x6 shaft 15 ft. deep is about $5 per foot below a depth of 7 ft., the upper 7 ft being figured on a yardage basis. The cost increases with depth. A 4x6-ft. shaft 10 ft. deep is generally considered by the United States mineral surveyors and others at Butte as costing $25. This is generally a fair valuation, but in some cases it is a little high.

Patent Work Done on Mining Claims

Patent work amounting to $25,000, done under the supervision of two men on about 50 scattered lode claims ranging from four to six miles from Butte, showed a cost of $0.80 to $1.25 per cu.yd. for opencut work and an average of $5 per ft. for tunnels. The work done on a single claim of this number for an expenditure of $500 aggregated 113 cu.yd. of opencuts and a partly timbered tunnel 3x6x84 ft. long. The cost of the tunnel, by allowing $1 per cu.yd. for the openwork, was $4.60 per linear foot. The work on all of the claims consisted of opencuts and tunnels with a few shafts. The deepest shaft was 55 ft., and the others were comparatively shallow. The cost of the deepest shaft to a depth of 47 ft. was $370, or nearly $8 per ft., and to the depth of 55 ft., $470, making the last 8 ft. cost $12.50 per ft. This shaft was sunk on a vein on a 45° incline, and was cribbed with an inside measurement of 3x5 ft. The broken rock was hoisted by a hand windlass in a bucket sliding up on guides. In this case the construction of the windlass and frame and other extra work made up for

the smaller cost of the first 7 ft. The formation was more or less decomposed Butte granite, and required blasting. From the last part of the shaft some water had to be bailed. It is considered that 55 ft. is just about the limit for economical sinking with a hand windlass.

Another shaft 4x6x15 ft. cost $48. This amounted to $1 per cubic yard for the first 7 ft., and a little over $5 per ft. for the remainder. The cost to the City of Butte of excavating the material in sewer trenches within the granite area amounted to $2.16 per cu.yd. The trenches were 2 ft. wide and averaged 9 ft. deep. All the work was done by contractors. Wages for ditch diggers are $4 per 8 hr. this being the minimum price for all laborers on city work, and is $0.50 per day more than is now paid to miners. This rate of wage has been fixed by ordinance of the city government. City contractors in Butte have to contend with numerous labor-union regulations. The higher cost per yard of this work than for opencut mining is due to the labor situation, the great depth and small width of the trenches, and the larger proportion of solid granite, consisting of boulders and ledges included in the softer material that has to be moved.

A 300-ft. tunnel run from the surface in a hard, compact granite cliff at the head of Rattlesnake Creek in Beaverhead County, cost $28 per ft. Several hundred feet of prospect tunnels on the porphyry dike in the Remini district, Montana, were run by contract for $3 per ft. Prospect tunnels in the soft porphyry in the lowlands district, Montana, cost from $2 to $5 per ft.

Tunnels in the soft schist in the Crevasse mining district, Montana, cost from $4 to $5 per ft.

Cost of Work in the Cœur d'Alenes

In the Cœur d'Alene mining district there are few outcrops and the surface on the mountainsides is generally covered with soil and angular wash to a depth of 2 to 8 or 10 ft. Under the overburden the formation in place nearly always is broken and shattered to an appreciable depth, but very seldom over 15 ft. or 20 ft. The formation is a series of sedimentary rocks which are, on the whole, easily eroded and weathered. There are a few hard strata, such as the copper beds in the Revette quartzite, which resist weathering and are as hard at the surface as at depth, but these comprise only a very small part of the whole series. Miners' wages are $3.50 for 8 hr. The cost of surface cuts here is found to be a little higher than at Butte, averaging about $1.20 per cu.yd. for the material removed. Individual cuts cost from $0.75 per cu.yd. when in wash, to $2 per cu.yd. when in the harder rock. The average cost of a series of cuts up to 7 ft. in depth on flat surfaces and with 12-ft. faces on side-hills, was $1.20 per cu.yd. In classifying the material most of the rock in place in opencut work would come under the head of loose rock.

The average rock in the Cœur d'Alenes is much softer than the solid granite at Butte, but harder than the altered granite. The cost of prospect tunnels in the Cœur d'Alenes ranges from $3.50 to $10 per ft., according to the hardness of the rock, with an average of about $6. The contract price of a tunnel in the shale above Pottsville, Ida., from 400 to 500 ft. from the portal, was $4.50 per ft. The total cost to the contractor, however, was $3.50 per ft. Surface prospect tunnels run by one of the mining companies in hard quartzite at Burke, Ida., cost $10 per ft.

Annual assessment work on five lime placer claims 12 mi. from the railroad on Pend d'Oreille River, in Washington, showed an average cost of $3.23 per cu.yd. of rock removed. Wages were $3.50 for 9 hr. The formation was tough, compact limestone and dolomite, with an entire absence of all surface weathering and overburden. The cuts were made in the bluffs above the river.

Development Expense in Washington

Development work in opencuts on lime placer claims at Metaline Falls, Wash., in solid limestone, cost from $2.50 to $4.10 per cu.yd. The cost per cubic yard of opencuts on a vein in disintegrated andesite on the north half of the Colville Indian Reservation, Washington, was $0.94 per cu.yd. The cuts averaged 34 ft. long, with 15-ft. faces. Wages $3.50 for 9 hr. The contract price for excavating solid rock in trenches 3x9 ft. deep in the City of Spokane, Wash., was $4.75 per cu.yd. This rock is a basalt of extreme toughness and requires an excessive amount of drilling and blasting. The contract price for the same work in opencuts in street work was from $0.90 to $1.25 per cu.yd. The cost to the city for removing gravel in the same-sized trenches was $0.90 to $1 per cu.yd. Wages are $3 for 8 hr. for city work. The contractors figure that 20% of the cost consists of overhead charges, interest and depreciation and 6% tax for workmen's compensation.

Opencuts made at Bingham, Utah, in weathered limestone and quartzite and slide rock, under my direction, cost $0.80 per cu.yd. Prospect tunnels in the same formation cost $4 to $6 per ft. Miners' wages were $3.25 for 8 hr. Hand placer work is cheaper, on the whole, than the same kind of work on the lode claims, which is to be expected from the nature of the material handled in each case. The formation of placers consists of stream gravel, sand or clay, with an occasional boulder, and in some cases cemented strata. Hand placer excavating is straight pick-and-shovel work except where boulders are encountered. In hand sinking on many placer properties the amount of water that has to be bailed or pumped out is the greatest factor in determining the cost, and often the quantity of water entirely prevents sinking. In many places cemented strata are entirely absent and what boulders are found are near bedrock and need not be moved in prospect work.

By considering how much gravel a man can handle per shift and his daily wage, it would be possible theoretically to arrive at the cost of most placer excavations. Byrne, on page 202 of his Inspector's Hand Book, gives the average amount of material a man can loosen per hour with a pick as, in clay or cemented gravel, 1 yd.; loam or loose gravel, 2 to 3 yd.; sand, 4 to 6 yd. On the same page he gives the average quantity a man can shovel per hour with a limit to the cast of 6 ft. vertically and 12 ft. horizontally as in rock, 1 yd.; clay or heavy soils, 1.7 yd.; loose earth or sand, 2 yd.

By taking Byrne's figures of 2½ yd. per hr. for loosening gravel and of 1.7 yd. per hr. for shoveling, a man in an 8-hr. shift could excavate a trifle over 8 cu.yd. of material. By allowing for miners $3.50 per 8 hr., the cost per yard would be $0.44. This agrees fairly well with other authorities, such as Gillette and Trautwine.

On placers, the cost of openwork or trenches up to 7 ft. deep with little or no water varies from $0.40 to $1 per cu.yd., depending on the nature of the material and the price of labor. Timbered prospect tunnels in gravel cost generally from $4 to $6 per linear foot. The cost of a 10 ft. shaft with little or no water is generally taken as being $10. Frozen gravel is not taken into consideration.

Trenches in city streets, particularly in a mountainous country, are quite often in material similar to that found on placers. Costs are generally kept fairly close on this work and can be used as a basis of comparison for placer work in similar ground.

At Missoula, Mont., it costs the Missoula Light and Water Co. an average of $0.36 per cubic yard to do the excavating for city water trenches 2x6 ft. The work is done by day labor, with wages at $3 for 8 hr. The material moved is almost entirely wash gravel, with an occasional hardpan.

The Great Falls Water Co., at Great Falls, Mont., in excavating for city water pipes moved 89% earth, 5% solid rock and 6% loose rock at an average cost of $0.34 per cu.yd. Wages were $2.25 for 10 hr. S. Lefevre, in his article in the February "Bulletin" of the American Institute of Mining Engineers gives the cost of surface excavations at Mineville, N. Y., in hardpan and boulders, as $0.80 to $1 per cu.yd. Wages for this kind of work are about $2 per 10 hr. Well diggers sink 5x5-ft. wells up to 30 ft. in depth on the Missoula Flat, at Missoula, Mont., on contract, at $1.50 per ft. including placing but not supplying the timber. Below 30 ft. the cost increases. The Flat is an old river bottom, and consists mostly of river gravel.

The Boulder Batholith

BUTTE CORRESPONDENCE

The Boulder batholith and its bearing upon the future of mining in the entire district was the subject of consideration and discussion at a meeting and banquet of the Montana section of the Institute of Mining Engineers in Butte, Oct. 8. The subject was presented by J. A. Grimes and was a continuation of the discussion on a paper prepared jointly by Mr. Grimes and Paul Billingsley and read at a previous meeting of the Montana section.

The Boulder batholith includes the granite formations that compose the mining district that centers around Butte. It extends from the Bannack mining district in southwestern Montana north to the Marysville district north of Helena and from the mining districts around Phillipsburg in Granite County on the west to and including the Radersburg district on the east.

This district ranks today, he said, as one of the greatest metal-producing sections, if not the greatest, in the world. From a special study, which took in 70 distinct mining districts in which are located over 700 mines that are either producing at present or have been producers at some period of their history, it is shown that the granite formation of the Boulder batholith bears a regularly defined mineral enrichment. The gold is found in the strata just above the granite formation in some districts, like that of Marysville in particular. The silver ores are found generally just on the upper edge of the granite. The silver-lead ores are found just below the upper edge, while the zinc ores are found at a somewhat deeper level. Below the zinc comes the copper formation, although this, outside of certain exceptional districts such as Butte, is of such low grade as not to be commercial ore. Going lower, they run into the iron-bearing quartz, and the indication is that the mineralized section does not run deeper than that.

Mr. Grimes noted four exceptions in particular to the rules that apply in the rest of the district covered by the Boulder batholith. These exceptions are the Hecla mine, the Granite-Bimetallic, the Elkhorn and the Butte districts. In the last, a depth of 3,400 ft. has not yet taken the explorations to the bottom of the copper-bearing ores, and in the Elkhorn district the end has not been reached at a depth of 2,400 ft.

The Gennamari Mill, Sardinia

BY C. W. WRIGHT*

The problem of remodeling the Gennamari mill, to be described, was a simple one because of the character of the ores treated. The object of the change was to increase the metal recovery and to reduce milling costs and thus permit the treating of lower-grade ores at a profit.

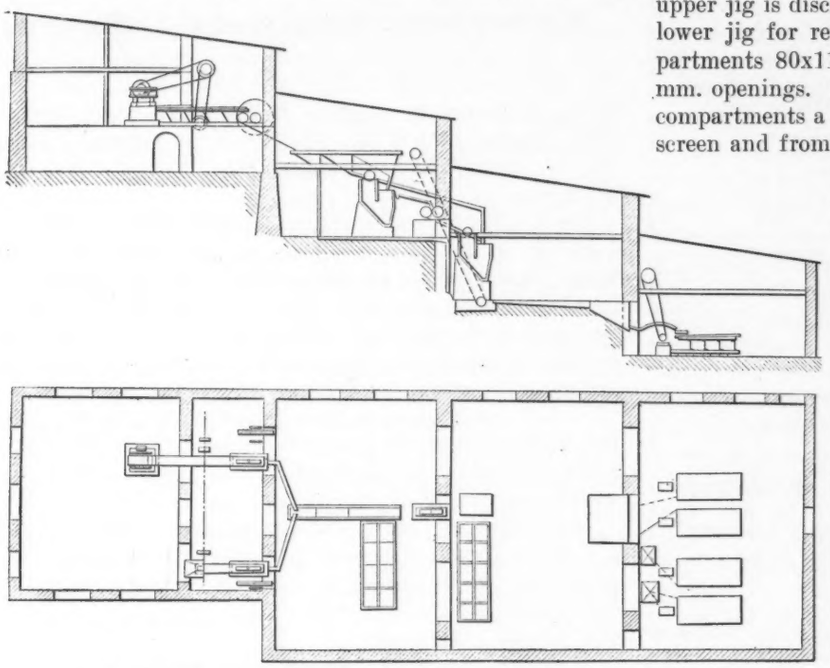
A series of careful tests at this mill in 1910, extending over several months, showed a metal recovery of only 60%, two-thirds of the loss being in the fines under 1½ mm. in size, all of which material was treated in a few small jigs. These tests showed the immediate need of tables for the treatment of the fine ore, which was being carried down the river and lost. Tables were designed and built at the mine, and eight were installed along with necessary classifiers and dewatering boxes. The metal recovery was gradually increased to 75%, which was largely due to the tables, though the costs were still high. The next change was to replace the small-sized Harz jigs, treating ½ ton per hr., with large jigs similar in type but of 6 tons or more capacity per hr., and to eliminate the system of close sizing. By these alterations, which are described in detail, the lead recovery was further increased to 80% and the costs of milling were reduced. Finally, last year, a plant for the retreatment of the slimes was built, using large spitzkasten, 3 slime tables and 2 corrugated rubber-belt vanners. This last improvement has increased the lead recovery to 86%.

DESCRIPTION OF THE GENNAMARI ORES

At the Gennamari mine the ore is galena, which occurs in fissure veins traversing both the granite and schist country rock. The veins in the granite contain quartz and siderite in about equal proportions as gangue minerals, while those in the schist have siderite, blende, pyrite, some calcite and quartz as gangue minerals. The veins average about 6% lead; the galena is in compact veinlets and pieces and not minutely disseminated, so that its separation is fairly simple. The coarse lumps of lead ore are sorted by hand in the stopes and on the *piazzales,* while the rest of the ore which averages from 3 to 4% in lead is transported to the mill. The material from the stopes, which yield a low-grade ore, is sent direct to the mill after a sorting out of the larger waste rock, which is left as filling.

*Mining engineer, Ingurtosu, Sardinia, Italy.

At the mill are bins of 250 tons' capacity equipped with grizzlies having 30-mm. openings to separate the coarse ore, which is delivered in cars along the side of the crushers and fed into them by shovel. The fine ore, which passes through the grizzly, is delivered into a small bin equipped with an automatic feeder. Both the ore from the crusher and the fine ore are fed to shaking screens with 15-mm. openings. The oversize goes to a set of rolls at the end of the screen, and the undersize goes direct to the screen below the rolls for further sizing. The opening between the rolls is set at about 10 mm., and they are kept in constant adjustment so that there is practically no oversize from the screens.



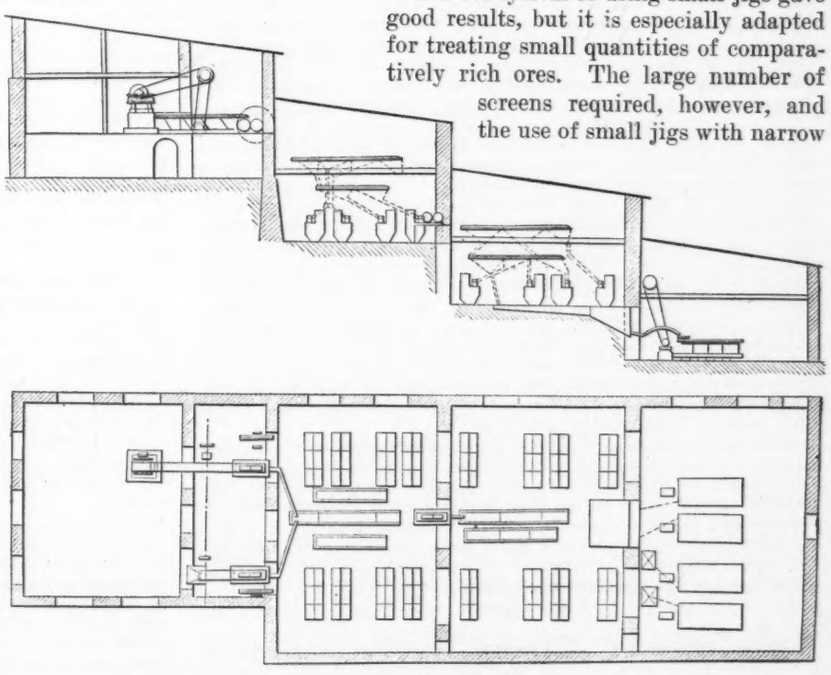
SECTION OF PART OF THE GENNAMARI MILL, SARDINIA

The main modifications in the mill begin at this point. They consist of a reduction in the sizing of the ores, thus requiring fewer screens and the use of larger jigs. Four of the shaking jigs have been abolished, and 14 small jigs have been replaced with two large ones. One section of the mill was first modified, and after six months of comparative tests the second mill section was also changed. A plan and elevation of both the old and new sections have been added and these show clearly the changes that have been made in the treatment methods.

The amount of ore treated is from 9 to 10 tons per hr. in each section. After the ore has been crushed, it is graded into 3 sizes, 0 to 1, 1 to 4, and 4 to 15 mm. The fine size, which amounts to about 15% of the feed, goes to the spitzkasten and on to tables for treatment. The size from 1 to 4 mm. goes to a lower jig, and the size 4 to 15 mm. is sent to the upper jig. The upper jig has four compartments 90 by 120 cm. in size. From the first compartment a galena product is made on the jig screen, having 5-mm. openings, and in the hutch. From the other three compartments a middling is drawn off above the jig screens through the pipe discharges and sent to a set of rolls to be reground, after which it goes to the lower jig. The hutch product from the last three compartments of the upper jig is discharged into a canal and sent direct to the lower jig for retreatment. The lower jig has five compartments 80x110 cm. in size, the jig screens having 3-mm. openings. From the first and sometimes the second compartments a galena product is obtained both from the screen and from the hutch. The middling product from the jig screen and the hutch of the other compartments is delivered to an elevator and is either sent to a set of regrinding rolls and returned to the lower jig for treatment or sent to a ball mill and treated separately.

The upper jig receives about 45 tons per shift and makes 24 tons of tailings containing traces of lead, 20 tons of middlings with 5% lead, and about 1,000 kg. of galena containing 55% lead. The lower jig receives 20 tons of direct feed from 1 to 4 mm. in size and 20 tons of recrushed middlings from the upper jig. This jig makes 35 tons of tailings with traces of lead, 14 tons of middlings with 5% lead and 1 ton of product containing 65% lead. The mill is only operated one shift of ten hours a day.

The old system of using small jigs gave good results, but it is especially adapted for treating small quantities of comparatively rich ores. The large number of screens required, however, and the use of small jigs with narrow compartments and screen areas naturally increase the cost of attendance, repairs and water consumption and make this method impractical for the treatment of a large tonnage of low-grade ore.



ANOTHER PART OF THE GENNAMARI MILL, SARDINIA

The following tables are added to show some of the advantages of the new method over the old one. As the

difference in the two systems is confined to the modifications in the screening and jig treatment, only these changes will be considered.

Comparison of Machines in Operation

Old Section		New Section	
Shaking screens, upper floor	3	Shaking screens	1
Jigs for coarse ore	6	Jig for coarse ore	1
Shaking screens, lower floor	2	Jig for fine ore	1
Jigs for fine ore	8	Elevator	1
Total number of machines	19	Total number of machines	4
Cost of machinery, lire	20,000	Cost of machinery, lire	10,000

Reduction in Power Consumption (Although Amount not Determined)

Water consumption per min., liters	1,080	Water consumption per min., liters	.380
Area of jig screens, sq. m	175	Area of jig screens, sq. m	85
Labor		Labor	
Screens	1	Upper jig	1
Upper jigs	3	Lower jig	1
Lower jigs	4	Screen, etc	1
Total	8	Total	3

Cost of Supplies and Repairs (Oil, Belting, New Screens, Etc.)

Screening, lire	224.53	Screening, lire	96.65
Jigging, lire	169.68	Jigging, lire	76.30
Transmission, lire	124.45	Transmission, lire	79.30
Total, lire	518.66	Total, lire	252.94

Besides the advantages mentioned, the new system permits a more accurate supervision of the jigs, with the result that more uniform products are obtained.

Antimony Mining in Bolivia

Antimony mining in Bolivia has recently been active, according to a correspondent of the London *Mining Journal*, who writes as follows:

As regards antimony, 1,315 tons were exported during the first five months of this year, as compared with 120 tons during the same period of last year. The high prices had already stimulated production, and since then there has been great activity. Antimony is quite widely distributed throughout the metamorphic slates of the Bolivian plateaus. The veins are not usually constant, but frequently form quite large pockets. So far there is practically no development work, and the ore being mined is superficial; still it is almost entirely sulphide of good quality, with little or no lead. No capital has been invested in antimony mining; work is from hand to mouth, and there are no reserves blocked out which might give an idea of the permanency of the deposits, but these are so numerous that with good prices there is no doubt that the output will be considerable. I have not any sure data to go on, but I think that at least 1,000 tons of antimony ore of over 60% is leaving the country monthly at the present time. Of course local conditions of scarcity of labor and means of transport soon limit output, and it is to a large extent at the expense of the tin mines that antimony is being produced; although, on account of the antimony deposits being at a lower altitude, part of the workmen employed on them are of a class that does not go up to the large mines.

The ore is spalled by hand, and naturally a good deal of lower-grade stuff remains in the dumps, as well as a considerable proportion of zinc, which by concentration would yield a good marketable product.

The high transport costs practically prohibit antimony mining in Bolivia except when prices are abnormally inflated, and therefore a stable industry cannot be counted on, the natural consequence being that no money is forthcoming for the development of the antimony industry.

Many commercial houses have been buying and exporting antimony, among them Gibbs & Co., which, I am told, has been doing so for the English Government.

Employees' Liens in California

By A. L. H. Street*

An owner of a California mine will not be subjected to a lien for compensation due an employee employed by one known by the latter to be operating the mine under an option to purchase the property, according to the holding of the California District Court of Appeal in the late case of Street vs. Hazzard, 149 *Pacific Reporter*, 770.

*Attorney at law, Minneapolis, Minn.

Another point decided in the same case is that the failure of the owner of mining property to file for record, as required by the California statutes, a notice disclaiming liability for work done on the property, does not give a lien to a workman who had actual notice of the fact that the owner was not his employer.

Volunteer Engineer Officers

In view of the program, which has been made public, of the Administration's plans for preparedness with particular reference to increases in the army, the following from General Orders No. 54, 1914, and General Orders No. 50, 1915, War Department, Washington, D. C., will be of interest.

For the purpose of securing a list of persons specially qualified to hold commissions in any volunteer force which may be called for and organized under the authority of Congress, other than a force composed of the organized militia, the Secretary of War is authorized from time to time to convene boards of officers at suitable and convenient army posts in different parts of the United States, who shall examine, as to their qualifications for the command of troops or for the performance of staff duties, all applicants who, being citizens of the United States, come within the prescribed limitations.

For engineers these requirements are, besides passing a satisfactory physical and moral examination and the presenting to the board of evidence of their technical qualifications together with a full statement of their professional experience,

3. For the grades of lieutenant—(a) The candidate must be an engineer in the active practice of his profession or in some business immediately connected with or concerned in engineering matters.

(b) He must either hold the grade of junior engineer, civil, electrical or mechanical, or higher grade in the civil service, or he must be a graduate from an approved engineering college, or belong to one of the following national engineering societies in a grade not lower than that shown opposite to each: The American Society of Civil Engineers—junior member; the American Institute of Mining Engineers—member; the American Society of Mechanical Engineers—junior; the American Institute of Electrical Engineers—associate. Or he must be or have been a noncommissioned officer of the grade of sergeant or above from one of the regular battalions of engineers.

4. For the grade of captain—(a) Same as 3 (a).

(b) He must either hold the grade of assistant engineer in the Engineer Department at Large or a corresponding engineer grade in the civil service in another department of the Government service, or be an associate member, or member of one of the national engineering societies enumerated under 3 (b), or have held a commission in the Corps of Engineers of the regular army.

(c) Sufficient knowledge of Field Service Regulations, Army Regulations, and Tables of Organization to understand the type of information of which these regulations are the source.

5. For the grade of field officer—(a) Same as 3 (a).

(b) He must either hold the grade of assistant engineer in the Engineer Department at Large or a corresponding engineer grade under the civil service in another department of the Government service, or be a member of one of the first three national engineering societies enumerated in 3 (b), or be a fellow of the American Institute of Electrical Engineers, or have held a commission in the Corps of Engineers of the regular army not more than two grades below that for which he desires to be listed.

(c) In addition to fulfilling the qualifications given in 5 (a) and (b), the candidate will be required to pass the examination prescribed herein for a field officer of infantry and an examination on the duties of engineer officers and troops in war, what they are and how they are performed.

Applications for examination, accompanied by recommendations and other documents of a commendatory character (as prescribed in General Orders 54), should

be made to the adjutant-general of the state, according to the legal residence of the applicant, in the month of May or November, to the end that the governor of the state may forward the accumulated applications with his recommendations in each case, to the adjutant-general of the army about Jan. 1 and July 1 of each year.

Mining in Boulder County, Colo.

SPECIAL CORRESPONDENCE

Boulder County, Colo., measuring 24 mi. north-south and approximately 32 mi. east-west, has unusually varied industries, due to the remarkable diversity in altitude, climate, geology and mineralization. Beginning at the eastern border there is a beautiful agricultural country with abundant irrigation and sustaining a thriving population. This area is underlain by splendid beds of lignite that have for years been extensively worked. The principal coal-mining towns are Lafayette, Mitchell, Superior, Louisville and Marshall. The surface of this coal-mining and farming area is a gently rolling prairie with an average altitude of about 5,000 ft.

Boulder, the county seat, lies immediately west of this farming and coal-mining area, where the plains and the foothills of the Rocky Mountains meet at an altitude of about 5,400 ft. Adjacent to the city—in fact, within it—the sedimentaries in the region to the east (where they lie practically flat) are tilted on edge, flanking great hills of metamorphic rock. In these steep beds may be found sandstones, limestones, shales and all sorts of clays. These rocks have been quarried for commercial uses, and the clays have been extensively used in the manufacture of bricks and refractory goods.

METAL MINES SITUATED IN THE HILLY COUNTRY

It is in the hilly country to the west of the city that we find the metal mines. Gold mining began here in 1859—almost contemporaneously with its beginning in the contiguous little county of Gilpin—and records show that the first location document ever filed in this state (then territory) was for a quartz vein not far from the city. Westwardly the hills rise back of one another to the crest of the continent, the county line, along which the average altitude is about 13,000 ft. Long's Peak, with an altitude of 14,271 ft., is in the very northwest corner of the county, while Arapahoe Peak, 13,176 ft. high, is about 22 mi. due west of Boulder. The station of Corona, remembered by all travelers over the Denver & Salt Lake (Moffat) Railroad, is in the southwest corner of this county.

The prevailing rocks of the mountainous country are granite, gneiss and schist, inclosing many strong dikes and sheets of siliceous porphyries. This is a region of typical vein fissuring. The veins vary in thickness up to 30 ft. or more and are inclosed by all the country rocks. They carry shoots or bodies valuable for their content of gold, silver, tungsten, lead and copper, all of which metals have been sought and mined commercially. Up to the present time little attention has been given to zinc, bismuth, vanadium and molybdenum, although these metals are known to occur here. They will unquestionably come in for recognition before long.

The veins that bear gold and silver are usually of complex character carrying sulphides of lead, iron and copper in addition to the precious metals. The gangue is usually quartz. The ores of the two precious metals generally contain both silver and gold, but the variations in the relative amounts of these metals are such that some mines are classed as gold mines while others (sometimes contiguous properties) are considered silver mines. For instance, near the town of Crisman, the Yellow Pine mine has made a large production of silver that was accompanied by but a trace of gold; while the Logan mine, next to it, has a production record of about $750,000 in gold. The White Raven mine, near Ward, ships high-grade silver ore containing little or no gold. In the '70s the Caribou mine was said to be the greatest silver mine in Colorado, but it lies in proximity to other mines in which the chief metal is gold. As a general statement, however, it may be said that the majority of the metal mines in this county produce ores in which the principal value is the gold content.

Gold occurs free in the upper zones of the veins, and amalgamation was the common treatment during pioneer times. Below the zone of oxidation, the gold often exists in the telluride form, sylvanite, and cannot be saved by amalgamation. Formerly the stream beds were washed by primitive placer methods and unrecorded quantities of coarse gold recovered. Silver occurs in the native state and as the sulphide, argentite. Very often its presence in ore is not discernible because it is so fine and in such intimate association with lead and copper sulphides.

TUNGSTEN MINING BECOMING AN IMPORTANT INDUSTRY

Tungsten occurs in a narrow belt crossing the mountains in a northeasterly direction. The veins are found where granite and schist are crossed by pegmatite dikes that appear to possess a direct relationship to the mineralization. These tungsten veins are usually richer when they have walls of granite. The gangue most closely associated with these occurrences of tungsten is hornstone or cherty quartz. The tungsten, itself, occurs as ferberite, the tungstate of iron, and as hübnerite, the tungstate of manganese. The main production has been of the former, a black, heavy mineral that predominates in the southern portion of the field, where most of the development has taken place.

Tungsten mining in this county has been contemporaneous with tungsten mining throughout the United States. It began in 1900, when shipments amounted to about 40 tons of equivalent 60% WO_3 concentrates. The largest production was in 1910, when it was equivalent to 1,221 tons of this material. Altogether, up to the present time, statistics show that the county has furnished about 60% of the nation's production. With the recent remarkable strength in the tungsten-metal market there has been a pronounced increase in mining and prospecting for the metal, and the 1915 production will reach record figures for both tonnage and value. The Conger mine is the greatest tungsten mine in the world, its production having a gross value of nearly $1,500,000.

Practically all the tungsten production to date has been in a small territory at the southwesterly end of the belt, near the town of Nederland. The metal was known to occur in other parts of the county, but it has been only within the past few weeks that miners have given serious effort to developing it outside of the limited area. Now tungsten has been proved in paying quantities

several miles northeast of Nederland, at the camps of Magnolia, Sunshine, Salina and Wall Street.

The metal-mining part of the county—containing, along its westerly rim, glaciers and perpetual banks of snow—is well supplied with streams that provide water for milling purposes. These mountains, below timber line, were formerly heavily wooded, and even yet in places there are fine stands of pine. The Colorado Power Co.'s 20,000-hp. hydro-electric plant at Magnolia is in this mining country, and its transmission lines traverse the various districts. Water for this power generation is impounded by a great dam in Middle Boulder Creek, is conducted 12 mi. through a 35-in. reinforced-concrete pipe line under gravity flow to a small reservoir at the top of a steep mountain, down whose slope a steel 48-in. pipe line carries the water 9,400 ft. to turbines, where it enters under a head of 1,830 ft. Moderate rates for current consumption have been established. The county is crossed by the Colorado & Southern, Union Pacific, Burlington, Denver & Interurban, Denver, Boulder & Western and the Moffat railroads. Of these, only the last two penetrate the metal-mining parts. The Denver, Boulder & Western, frequently spoken of as the "Switzerland Trail," is narrow-gage and reaches most of the metal-mining camps.

Pioneer miners divided the metal-mining part of the county into eight so-called mining districts, known as Gold Hill, Central, Ward, Grand Island, Sugar Loaf, Magnolia, Boulder and Snowy Range. Necessarily, these districts are comparatively small, since the entire metal mining area is not over 15 mi. square. The Gold Hill district was the first organized in Colorado, and it also contained the first stamp mill, machinery for which was hauled by ox teams from St. Joseph, Mo.

Manifest Advantages Led to Unscrupulous Speculation

Because of its easy accessibility, its splendid climate and its actual mineral production, this county years ago fell a victim to practices of unscrupulous or inexperienced mine promoters who, securing options to attractively situated claims, incorporated companies and sold stock broadcast, little or no actual mining resulting from such financiering. Often, the capital raised by sales of stock was foolishly expended in the premature erection of showy milling plants. Perhaps some of these defunct concerns never had any sound bases for mining operations, but probably the majority of them might have succeeded had they been managed by mining men instead of sharpers.

Some Boulder County mining enterprises met their doom when, after legitimately and successfully operating for a long time on their oxidized ores, they encountered the sulphide and telluride ores that were distinctly refractory to the simple milling methods of a decade ago. Such companies were obliged to discontinue operations or to entirely reconstruct their plants and revise operations. Such crises occurred about the time of general national financial depression and the propagation, by magazines of large circulation, of the theory of the unsoundness of mining investments; with the result that the metal-mining industry of Boulder County has languished, or at least stood still, for years.

There is now, however, a decided revival of interest. Old mines are being reopened, new prospects are being exploited, and milling plants are being installed to treat ores by modern methods. A few operators are giving attention to the mining and treatment of low-grade ores, such as were avoided in the past. Because Boulder County projects have failed in numerous instances, the region is, by some, accused of being "pockety" in the sense that oreshoots are of trifling extent and that profits derived in mining some rich bodies are absorbed in developing new ones. This is not a wholly just charge. It is no more applicable to veins in this county than to those of any other typical vein district. Reference to a map will show that Boulder County is really part of the general mining area covering also Gilpin and Clear Creek Counties to the south. The veins of western Boulder County are, in fact, identical in their characteristics with those of Gilpin County. Nor is the latter county active, but nobody that knows this famous little district will say that its veins are defective or worked out, or that the ore occurs in small and widely spaced pockets. Analysis of the depression in mining activity in this region will show that it can be explained by reasons that are quite apart from natural deficiencies. Among such reasons are the lack of local plants for treating the sulphide ores, failure to accept and adopt new methods, erection of mills with capital that should have been used in development, unsystematic and illogical systems followed in mining, almost complete nonemployment of trained engineers or metallurgists, management of enterprises by wholly inexperienced persons, and the failure on the part of Boulder County residents in the past to oppose illegitimate schemes.

But a new order of things will hereafter prevail, and mining activities will be guided by men of experience. An encouraging thing is the experimentation or research that is being carried on by experienced millmen and metallurgists. Cyanidation and flotation are being adopted in some instances. It is hoped that future mining operations will not be managed by needy relatives of Eastern investors or by men whose only mining experiences have been in small districts like this one, in which economics has never been a serious study.

Social Improvement at Lead

Special Correspondence

A survey of conditions in a Western metal-mining camp from the viewpoint of a sociologist is always interesting to many classes of people. There is no denying that many employers have rather derided efforts toward social betterment and regarded them as a weakness on the part of their fellows who indulged in them, and failed to consider the increased efficiency obtained through better moral and social conditions. Our great industrial leaders have now changed their attitude and are giving serious consideration to the results of the work done in the field of social welfare.

Among the places under scrutiny is the little city of Lead, S. D. This municipality of 9,000 people is the abode of the Homestake property, classed as one of the world's greatest gold mines. Lead was one of the places visited by the Congressional Commission on Industrial Relations which investigated its first and only labor difficulty in 35 years of operation. Professor Commons, who displayed much interest in Lead, pronounced it the most remarkable and interesting community he had observed. From the fact that only one clash had occurred between the owners and their employees and the additional fact

that at least half of the men sided with the company in that trouble, one would correctly infer that much effort had been made to keep the miners satisfied with the working conditions and to maintain harmonious relations and comfortable living conditions.

Both the late superintendent, Thomas J. Grier, and the present incumbent, Richard Blackstone, entered the service of the Homestake Mining Co. shortly after its organization and consequently were closely identified with every movement inaugurated to preserve harmonious relations with the workmen. Both displayed interest in the social life of the men and may be properly classed among the men of business who first saw practical benefit through better social and living conditions.

One of the results of this interest is what is known as the recreation building. This was erected at a cost of $350,000 by the Homestake Mining Co. for the free use of its employees and the people of Lead. It contains the finest theater in the state, a magnificent swimming pool and rooms equipped for all forms of indoor recreation. Here is installed the famous Hearst Free Library, equipped and maintained by Mrs. Phoebe Hearst. The building forms an important part of the social life of the community and is a strong link in the chain of common interest between employer and workman.

The free medical and hospital service for all employees and their families; the Aid Association, which provides insurance at a minimum cost against sickness, accident and death; the auxiliary, a woman's organization to care for any cases of temporary destitution or need; and the liberal financial assistance to churches—these are among the measures that were inaugurated and fostered under the direction of the former and present managers. These things could not, of course, come in any other way than by gradual growth. During the reign, so-called, of the Western Federation of Miners many of the men took a position in opposition to everything proposed by the company and preferred to provide their own relief measures through their own organizations. Likewise the amusements and forms of social recreation were those supplied by people who collected a profit from them.

During the transition period following the fall of the Federation, the influence of the employers was predominant and there were suggested and placed in operation many measures which at other times might have been difficult to explain, both to directors and to employees. The pressing needs of the hour in caring for perhaps fifteen hundred new employees and their families permitted the easy introduction of better forms of entertainment as well as better sanitation and advanced safety methods. Once inaugurated, the ideas grew and developed with little notice or adverse comment. Measures to secure a home for each family desiring to own one were provided.

"Safety-First" methods, which would have been derided in the old days, were taken up with enthusiasm, and the eager desire for increased efficiency enabled a first-aid team of but a single year's existence to win the first prize at the Panama-Pacific Exposition in competition with the oldest and best teams in the country.

Figures showing a comparison between the number of accidents to employees under the old and the new methods and those showing the improvement in the number of hospital cases and serious cases of sickness are startling and offer in themselves a sufficient excuse for every advanced measure inaugurated.

Chronology of Mining for October, 1915

Oct. 3—Arizona militia ordered to Clifton on account of strike disorders.—Crushing begun in mill of United States Gold Co., Boulder, Colo.

Oct. 6—Operations resumed at Butte-Alex Scott.

Oct. 9—Derry Ranch dredge near Leadville, Colo., went into commission.

Oct. 10—Shafthouse and equipment of Matchless mine, Leadville, destroyed by fire.

Oct. 11—Commencement of suit of Elm Orlu vs. Butte & Superior.

Oct. 13—Pilares mine of Moctezuma Copper Co. and the concentrator at Nacozari, Sonora, closed down.

Oct. 14—Production of electrolytic zinc begun at Anaconda, Mont.

Oct. 16—New stamp mill of Brunswick Consolidated started.

Oct. 18—Stockholders of Tennessee Copper Co. approved the issue of $3,000,000 first-mortgage 10-year convertible 6% bonds.

Oct. 19—Carranza government in Mexico recognized by the United States.—Explosion of dynamite at Granite Mountain mine, Butte, Mont., 14 men killed.—Viloro dredge No. 2, Oroville, Calif., burned and sank.—Plant of Mineral Products Co., Marysvale, Utah, started operation.

Oct. 21—First spelter made at Donora, Penn.

Oct. 23—Stockholders of Southern Aluminium Co. voted to dissolve the corporation.

Oct. 25—Operations suspended at Cananea owing to cutting of railway by Yaquis.

Oct. 26—Beginning of strike at Silver King Coalition mine, Park City, Utah.

Japanese Phosphate Trade

Owing to the European war, Japanese imports of phosphate rock have been greatly interfered with. Florida phosphate is generally used by the fertilizer manufacturers of Japan, and in ordinary times costs about $7.25 per ton, while at present the freight rate alone is about $13.75, which, being added to the original cost of the phosphate, comes to about $20 per ton. Under these circumstances, efforts are being made to supply the Japanese companies with domestic products.

The Japan Phosphate Co. of Tokyo contemplates working its mine on a large scale, while the Rassa Island Phosphate Co., which has the biggest phosphate mines in Japan and which produces ordinarily about 50,000 tons per year, is said to be making preparations for a greatly enlarged production. The Japanese phosphate is said to contain a large percentage of iron, alumina, etc., and consequently is reputed to be a poor material for the manufacture of superphosphate, but under present conditions the Japanese enterprises may prove profitable.

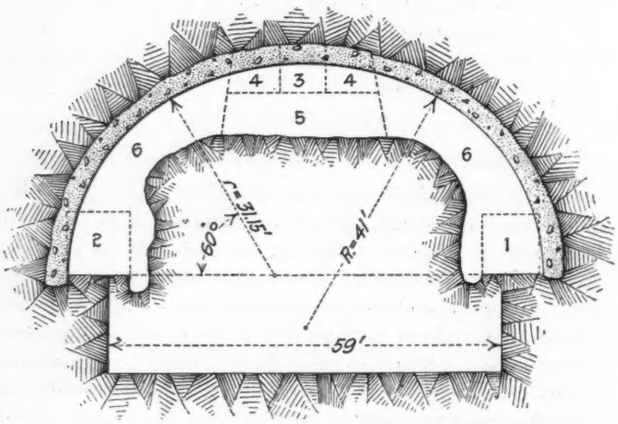
The Production of Nitrogen Compounds in Germany, particularly sulphate of ammonia and cyanamide, has been considerably increased during the course of the war, and the sale price of nitrate is said to have been lower than the cheapest price of the last 10 years, according to the "Journal of the Society of Chemical Industry," Sept. 30, 1915. In order that on the conclusion of peace the newly developed German industry may not be confronted with destructive foreign competition a national monopoly is now being considered.

Details of Practical Mining

The World's Largest Tunnel

The largest tunnel ever undertaken is that which has been partly driven at Marseilles, France, for the Marseilles-Rhône Canal for use as a barge-canal tunnel. The work was suspended at the outbreak of the war and the date of resumption is of course problematical. The tunnel, lined throughout, is nearly 4½ mi. (7.2 km.), is 22 m. (72.2 ft.) wide inside the lining, and the crown of the arch (nearly semicircular) is 9.90 m. (32½ ft.) high. The depth of water is to be 3 m. (10 ft.).

Excavation was begun by driving at the right a heading with a cross-section of 75 sq.ft., with its base at the elevation of the towpath. A second heading, of 96-sq.ft. section, was driven at the same elevation on the left side, parallel to the right heading; and for the purpose of checking the alignment and for ventilation, this was connected with the first heading by cross-drifts every 328 ft. A third small heading was then driven at the summit of the arch, and openings of 43-sq.ft. cross-section were driven to this heading from the two side headings every 60 ft. This third heading was then widened, and the excavated material was dropped through the cross-drifts



HEADINGS IN THE MARSEILLES-RHONE CANAL

into cars operating in the side headings. The top heading was then lowered, and finally the connection with headings 1 and 2 was accomplished as shown in the accompanying sketch.

In the meantime the footings for the masonry arch were laid and the arch centering was erected, being supported on the unexcavated core of the tunnel. The masonry of the arch ring was laid in sections 19 ft. long. Every third one of these sections was built, and then the intervening rings were undertaken. After the completion of the arch masonry, the remaining core was removed.

Before the tunnel proper was begun, two shafts 11.48 ft. in diameter, distant 8,200 and 17,800 ft. respectively from the south portal, were constructed, the former having a depth of 460 ft., the latter of 230 ft. These will serve for the ventilation of the tunnel.—*Engineering News.*

How The Repair Man Sees It

By Harry E. Scott*

How many mine superintendents would stand for an engineer taking a double-jack and pounding the piston of an engine or compressor, should it fail to do its work properly from overloading, or, in fact, from any cause? Without a doubt that engineer would next be seen headed toward the timekeeper's office with a nice large can on him. This holds good on everything in the mechanical line with one exception—that is, the misused and neglected air drill of all kinds and makes.

The management is always kicking about the cost of repairs; the foreman, about the footage and tonnage; the shift boss, about too much time being lost setting-up, getting steel, water, etc. The machine man kicks all of the time—the ground is too hard or too soft, the drift too high or too low, the air poor, the drill no good, the steel poor, and many other things too numerous to mention. They do not stop to consider that on the modern drills they are making machine runners much faster than they did years ago, when a man had to know more than the difference between the chuck and the crank before he could draw a machineman's check.

At the present time a young fellow who knows nothing about mining, and has never broken any ground except by the acre or in digging trenches for some of the warring nations comes into a mining camp. He rustles the proper official and gets a "job" mucking. In about a week the shift boss goes down the hole in the morning and is short a machine runner. The young fellow is not much force on the muck-stick as yet, possibly the poorest mucker in that stope, and as the shift boss does not care to spoil a good mucker, he puts the new man on a drill of the unmounted type. The latter knows nothing about it and is told practically nothing except that he must get "rock in the box" and lots of it.

The young fellow wants to make good, as there is more money and more glory in being a machine man than in being a mucker. He is shown where to drill, makes a few trips to the level for drill, hose, and steel, and at last everything is ready. He has no oil, but that makes no difference; it will run, so needs no oil. He has no trouble until the hole is two or three feet deep; then the steel sticks from one of many causes and refuses to rotate. He makes it turn by twisting on the handles, and about the second twist the machine stops.

When the shift boss arrives, making his rounds, the drill is sent to the shop, the rotation on the bum. Of course the machine man did not break it—it just stopped, so he says.

In from one to two hours it comes back. He is in a hurry now to make up for lost time, so he grabs a steel and rams it into the chuck. The hole is not large enough for the water tube and when the steel is taken out of the machine the tube comes with it; then back to the shop.

*Morenci, Ariz.

This performance continues for about three days if someone does not take pity on him and put him wise; then he wonders why they handed him his time. It would have been much better from the efficiency standpoint, to have taken time, possibly 30 min., and explained enough about the drill to get him started right, provided there was not an experienced man on the job.

The older men on this type of drill are nearly as bad as the green ones. Their troubles consist chiefly in running without oil, using the air and water connections for handles and breaking them off, dropping machines down ladderways instead of letting them down with a rope, taking drills apart underground and putting them together incorrectly or losing some of the small parts, and many other things that do not increase the efficiency or life of the machine. In a large percentage of breaks on air drills it is not the fault of the drill, but of the man behind it.

In the running of air drills of the mounted type we see some foolish things, which at times are amusing, such as throwing wrenches, hammers, steel, pounding the chuck, piston, drill or anything that happens to get in the way, because the machine will not run. It would be much easier to line up to the hole or change the bent steel for a straight one and let the machine do the work than to pound it in with a hammer or chuck wrench.

In drills of this type there are many things for the efficiency man to consider, of which the following are a few: The setting-up of the machine in the proper place and distance from the face, having it close enough to get the cuts at the proper angle to break well in hard rock and far enough away to make changes in steel without too much trouble and delay. The machine should be oiled at least twice a shift with good oil—not too light, as it will blow through the drill and do very little good. The heavier oil may gum somewhat, but it is better than the light oil, which goes on through and leaves the machine dry after the first hole.

The following tests, made in a repair shop, of three different classes of air drills show the wisdom of sending drills to the shop to be overhauled and cleaned at proper intervals: A piston machine was tested in the shop and consumed 195 ft. of free air per min. It was overhauled and a new front-head leather used, then tested again, taking 117 ft. at the same pressure. A stoper consumed 101.5 ft.; after cleaning and oiling, 75.6 ft. A jackhamer took 79 ft. on arrival and 63.4 when overhauled. In the two latter drills absolutely no new parts were used.

If the air drill was given a small percentage of the care and attention that other machinery receives, the efficiency would be greatly increased.

Handling a Long Heavy Cable Underground

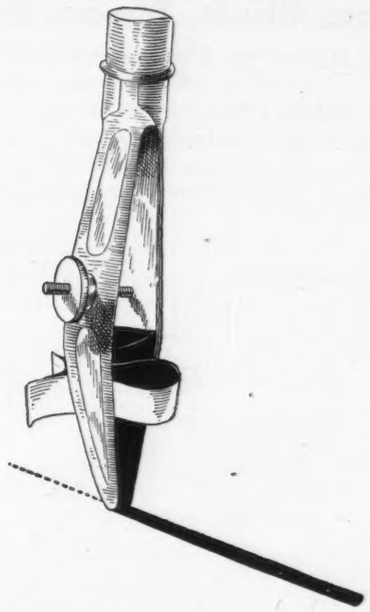
By James Humes*

At the Silver King Coalition mines in Park City, Utah, a cable, capable of carrying 800 hp. at 2,300 volts, and weighing about 6 lb. per ft., was taken into the tunnel in sections 1,200 ft. long. The reels that held these sections were too large to go in the tunnel. The cable was therefore fastened to the electric locomotive and strung out on mine cars spaced about 30 ft. apart. This scheme worked all right on the straight track, although some trouble was experienced on the curve to keep the small cars from tipping over. Despite this slight trouble, the scheme proved a very satisfactory one.

*Superintendent, Silver King Coalition Mines Co., Park City, Utah.

A Pen Kink for Draftsmen*

It is often necessary to draw heavy lines in the drawing office. By putting a piece of bent drawing paper between the blades of a tracing pen as shown in the illustration,



A DRAWING PEN FOR HEAVY LINES

thus increasing the capillarity and flowing friction of the ink, very heavy lines can be drawn and blots at the end of the lines avoided. The pen can also be filled with more ink.

Paint Required for Structural Work

In a pamphlet entitled "Engineer's Handbook on Protective Coating," published by the Goheen Manufacturing Co., paint engineers, Canton, Ohio, are given tables which show that for highway bridges the amount of paint required varies from 0.014 to 0.028 gal. per 100 lb. of bridge, for lengths of span varying respectively from 300 to 20 ft. For single-track railway bridges the paint required is 0.008 gal. per 100 lb. of bridge, regardless of the length of span.

For I-beams the amount required varies from 0.46 gal. per ton of 3-in. I-beams to 0.16 gal. per ton for 24-in. beams. For channels the amount varies from 0.48 gal. per ton for 3-in. beams to 0.22 gal. per ton for 15-in. beams. For buildings in general, 12 lb. of iron will average 1 sq.ft. of surface requiring painting, to which is to be added 10% for corrugations where corrugated iron is used.

The approximate cost for labor per ton for applying the paint, working on the ground, is equal to the cost of paint per ton of steel. For elevated work anywhere

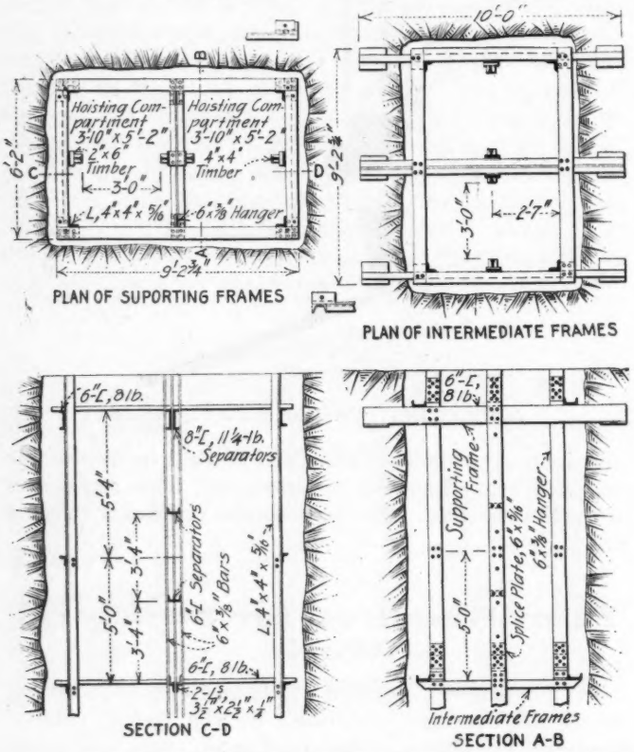
*A. O. Alexay, in "American Machinist," Oct. 28, 1915.

from 10 to 50% should be added to the cost of labor on the ground, depending on the amount of scaffolding and climbing necessary in the work.

For steel-riveted pipe the number of gallons required per lineal foot of pipe equals the sum of the inside and outside diameters in inches, multiplied by 0.000262 for first coats and by 0.000174 for second and succeeding coats, adding 3% for laps. All figures are for one single coat, except as noted, and are for paint manufactured by the Goheen company.

Steel Shaft Timbering*

At the Los Ocotes copper mine in the State of Oaxaca, Mexico, an 800-ft. shaft was timbered with steel, the details of the shaft-set being shown in the accompanying sketch. Supporting, or bearer, sets made up of 8-in. steel channels were cemented into hitches cut in the side of the wall. These supporting sets were installed just below



DETAILS OF STEEL SHAFT TIMBERING, LOS OCOTES MINE

the collar and at 210-ft. intervals in the shaft. All the steel, before being installed, was painted with a mixture of coal-tar and turpentine. From the surface to the 600-ft. level, sets were put in 10 ft. apart. From the 600- to 800-ft. level, because the ground showed a tendency to cave, the sets were put in every 5 ft. The lagging of 2-in. planks was laid lengthwise between the sets.

For timbering this shaft about 73 tons of steel was required, costing approximately $100, United States currency, per ton laid down at the mine. A steel gallows frame was erected containing 15 tons of steel, which cost about $140, United States currency, per ton laid down at the mine. This is at the rate of 5c. and 7c. per lb. and does not include the cost of erection.

*Abstract from article by R. H. Cromwell in "School of Mines Quarterly."

Telling Time with a Compass

It is commonly known that points of the compass can be determined by the use of a watch. By pointing the hour hand toward the sun, a bearing half way between the hour hand and 12 o'clock on the watch, is true south.

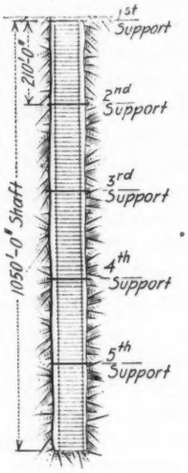
It is not generally known that time can be told by the compass with equal facility. Take the true azimuth or bearing of the sun and subtract from it 180°; multiply the remainder by the fraction $^1/_{15}$, and the result will be the hours before or after 12 o'clock noon.

How Electric Blasting Saves*

In blasting of all kinds, the most modern method is firing by electricity. The apparatus necessary to use depends on the kind of blasting, but from the following list one can easily select the proper ones for his work: Blasting machines, electric blasting caps, waterproof electric blasting caps, delay electric blasting caps, delay electric igniters and electric squibs.

Where electric power is used this can be substituted for blasting machines with better and more satisfactory results, provided the proper voltage and amperage are used.

In coal mining, ore mining, tunneling, shaft sinking, etc., where it is necessary that all charges do not detonate at the same time, it is economical to use either the delay electric blasting caps or the delay electric igniters. These can be used in the same circuit with the electric blasting caps. By their use the various charges can be detonated at different intervals as desired.



Advantages of electric firing are:

1. Charges of explosives can be detonated at the time and in order desired.

2. There will be no hang-fires, which often happen when using fuse and blasting caps.

3. In shaft sinking, should the hoist refuse to work after a round of holes with fuse is lighted, the shot-firers' lives are in great danger. This is entirely eliminated, as the charges of explosives can be detonated from the surface.

4. The inconvenience and danger from misfires because the fuse has failed to burn through or because it has been damaged from storage are eliminated.

5. Because the electrical-blasting method is economical, safe and sure, and therefore cheapest in the end.

Explosives for Sheet-Ground Mining in Joplin

In a paper prepared for the Gogebic Range meeting of the Lake Superior Mining Institute in September, Edwin Higgins, mining engineer of the Bureau of Mines, Ironwood, Mich., states that in the sheet-ground mines explosives count one of the chief items of mining expense, varying from 20% to as high as 30% of the total cost. A box of powder breaks from 30 to 45 tons of dirt, according to the nature of the ground.

*Du Pont Magazine, September, 1915.

Details of Milling and Smelting

Truax Zinc-Slag Treatment

Sewall Truax, of Cañon City, Colo., has patented (U. S. Pat. No. 1,155,628, assigned to the Granadena Mining Co., an Arizona corporation) a method of treating zinc-bearing material, especially zinc slags, by passing them in a fluid condition over finely divided reducing material, such as coke or carbon, the particles of which are prevented from passing into the fluid by being mixed with a binder such as clay.

The lining or bottom of the furnace is made of such a mixture of fine coke and clay rammed into place. A good mixture consists of coke of graduated sizes, from a maximum of 1-in. pieces down to fine dust, and 25% or more of a plastic clay. The furnace is heated by means of oil, pulverized coal or other suitable means, and as the slag or other zinc-bearing material comes in contact with the coke in the furnace bottom, the carbon monoxide formed by the action of carbon on zinc oxide or zinc silicate, rises in small bubbles through the melted mass and comes into intimate contact with a further portion of zinc oxide or silicate, liberating metallic zinc and producing carbon dioxide, which rises and passes off with the vapors of zinc, and at a lower temperature oxidizes the zinc again to oxide in case no free oxygen is present. Usually oxygen is present in the atmosphere of the furnace, and so zinc oxide and carbon dioxide are given off in the vapors. The zinc oxide may be collected in a baghouse in the usual manner.

The consumption of coke is stated to be about 20% of the zinc driven off, or in the case of slag containing 10% zinc the consumption of coke is about 2% of the weight of the slag treated. Experiments indicated that zinc above 0.5 or 0.6% of the weight of the slag is readily removed. The carbon and clay are replaced by "claying" the sides and bottom of the furnace with the brasque.

Preparing Pulverized Coal for Reverberatory Furnaces

E. P. Mathewson states that in many places reverberatory copper-matting furnaces using pulverized coal as fuel can be operated more cheaply than blast furnaces, even where the coke consumption in the blast furnaces is as low as 8% of the charge. He summarizes[1] some of the main considerations in the successful use of pulverized coal in reverberatories, as follows:

> Coals varying in ash from 5% to 23% have been used successfully in pulverized form. Two points are essential for success: The coal must be dried below 1% moisture before pulverization; and the pulverization must be carried to a very fine point. Preferably, not over 5% of the pulverized coal should rest on a 100-mesh screen, while 95% should pass through 100-mesh screen; not over 20% should rest on 200-mesh screen, while 75% should pass through 200-mesh screen. The flame is as easy to handle as gas; the ash is caught to the extent of 50% in the flue connection between the furnace and the waste-heat boiler, the balance being absorbed by the charge.

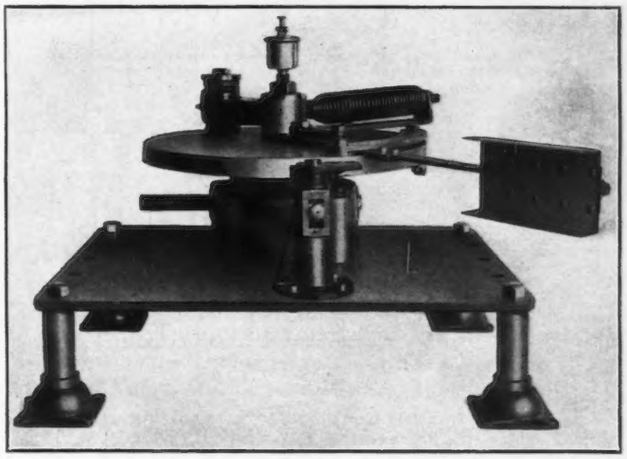
[1] "Symposium on the Utilization of Fuels in Metallurgy," International Engineering Congress, 1915, San Francisco, Calif.

Bardill Sampling Machine

By J. O. Bardill*

This machine was designed for sampling wet and sticky mill concentrates and similar materials. The photograph shows the construction. The principal elements are a turret and its worm-gear drive, incased in an oil-tight housing. A cutter arm is pivotally mounted on the turret and revolves in unison with it, except through about 40° in each revolution, while it is being held stationary by a vertical detent bolt.

The relative motion between the turret and the cutter arm effected during this 40° period of inactivity of the cutter arm produces tension in the coil spring shown, which is exerted between the turret and pivoted cutter arm. A cam underneath the rim of the turret releases the



THE BARDILL AUTOMATIC SAMPLER

detent bolt at the proper time, causing the cutter to pass rapidly through the stream owing to the spring action independently of the motion of the turret.

The action of the cutter arm is extremely rapid, and it is suddenly stopped by its opposite end coming in contact with a rubber buffer post. This absolutely clears the cutter of any material that might adhere. The material is deposited in a receiving box properly placed, and the cutting action and delivery are done so neatly that there is no spilling. The power required is so slight that the turret may be operated through its entire revolution, and against the spring action, by turning the wormshaft by hand.

Reference to the diagram shows that the machine may be placed in close quarters, only about 12 in. being required vertically in the stream between discharge of hopper and top of conveyor belt.

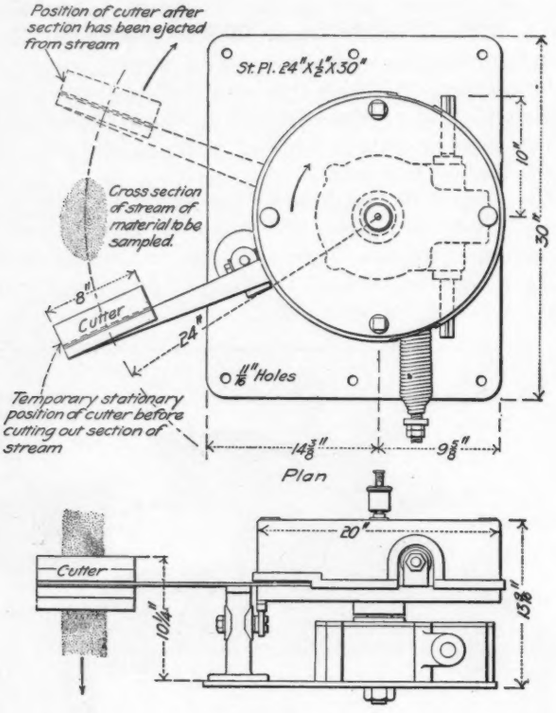
The machine may easily be made into a self-contained, portable affair by mounting a small driving motor on the base plate.

A sample removed from two carloads containing wet lead concentrates weighing 126,940 lb. and delivered

*450 Lafayette Ave., Palmerton, Penn.

from the storage hopper to a conveyor belt by means of a 6-in. screw feeder weighed 495 lb. The stream was cut six times per minute and the dimensions of the cutter were 4 in. wide and 8 in. long. The length of cutter has no bearing, of course, so long as it is sufficient to take in the entire stream. This sample was produced by 840 cuts, 0.59 lb. per cut, percentage of total weight 0.39. Expressing this in terms of volume, each 0.83 cu.ft. had removed from it 5.6 cu.in. in one cut.

Since 140 min. were consumed in handling this material by the conveyor running at a speed of 275 ft. per



THE BARDILL AUTOMATIC SAMPLER

min., these concentrates were distributed in the form of a band approximately 38,500 ft. long, from which 840 cuts were removed at intervals of 46 ft. The analysis of this sample checked absolutely with a "one-in-ten" shovel sample taken from this lot.

Smelting at Anyox, B. C.

Smelting operations at the Granby Consolidated Mining, Smelting and Power Co.'s plant at Anyox, B. C., are gradually rounding into shape as the peculiarities of the ores are becoming better understood and necessary changes in equipment made to conform to the conditions now being established as best suited to economical work. The usual difficulties of starting a new works were augmented by the large amount of fines on the charge, the increasing content of silica and the aluminous character of the ores.

The reports for the year ended June 30, 1915, of W. A. Williams, superintendent of smelters, and of A. J. Bone, superintendent of the Anyox plant, give an interesting résumé of the progress that has been made in working out the metallurgy at this plant. The works was started in March, 1914, and the problem was not merely to smelt the Anyox ores, but to determine conditions of maximum tonnage and minimum expense for a new property. Commenting on the progress that has been made, Superintendent Williams says:

> We commenced operations as a pyritic plant, using low coke and very little flux, No. 1 ore being used as a base to smelt No. 2 ore. The ores have not come to us as free from inert materials, such as dike and schist, as we could wish. They have been more or less erratic as to the silica content from day to day, and the tendency in both ores is to higher silica and alumina. This fact, coupled with the shipment of about 100 tons of foreign ore per day, has made it hard to operate the furnaces as originally intended, and the coke and flux percentages have risen to some extent. With the greater development of our own orebodies and with the better storage facilities at the mine and smelting plant, this should be materially helped. We have been trying to make a converter grade of matte in the first operation, but have found it to be the better practice to regrade our matte. The making of converter grade of matte in the first smelting, we believe, will eventually be accomplished.

Several changes and additions to equipment have been made with the purpose of improving operating conditions and lowering cost. These include new charge cars, matte machine, increased crane capacity, a skull grid, silica bins over converters and additional ore-storage bins, all of which have been charged to "Operation." A fourth blast furnace has been constructed and placed in operation, and an agglomerating plant for handling converter slag, flue dust and similar materials. Discussing the smelting operations in more detail, A. J. Bone says:

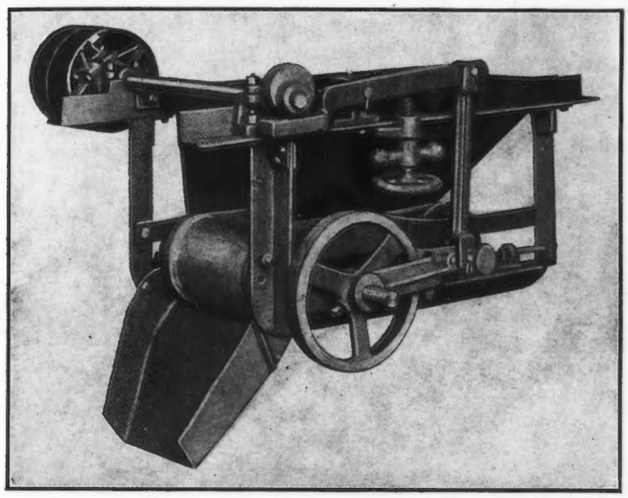
> The ores smelted covered a wide range in analysis, from low silica, low alumina, requiring quartz and little coke to smelt, to the other extreme of high silica, high alumina, taking a basic flux and higher coke. Of late the tendency has been toward higher silica content. We are also receiving about 100 tons daily of siliceous custom ore. The result of these conditions is to curtail the use of quartz in the blast furnaces and increase the consumption of limerock and basic "Mamie" ore, and consequently the percentage of coke.
>
> It may be suggested that our slag is comparatively low in silica. The obvious remedy for increased silica in the ore would be to make slags higher in silica. In this connection it should be remembered that the bulk of the iron that enters the slag is oxidized in the furnace and combines with silica in conformity with the principle underlying slag formation in pyritic smelting, namely, that the temperature prevailing in the focus determines the particular ferrous silicate which results. Working along natural lines, our endeavor would be to make more slag in the furnace—not to alter its character. In other words, by obtaining a greater degree of oxidation, more ferrous oxide will be furnished to slag silica and at the same time make less matte but of higher grade.
>
> During the last quarter of the year, the first matte, when too low grade, has been resmelted with siliceous ore and brought up to 20% or 25%. Even this grade can be considered low as converter mattes go, but with it the converter department can produce at the rate of 3,000,000 lb. per month with ease. One of our chief concerns is to make matte of suitable converter grade in the first smelting, and though no permanent success in doing this can yet be recorded, it is not improbable that efforts in this direction will be successful.
>
> Recently the system of feeding the furnaces was improved through the adoption of Anaconda-type charge cars. These permit a more favorable placing of the charge, the advantage of which was immediately reflected in a marked decrease in crust formation. Incrustation in the upper part of the furnace shaft has been responsible for terminating fully 90% of the campaigns. These for the year were very brief, averaging only 13.6 days, but with the new cars, longer campaigns are the rule. A saving of labor on the feed floor was also made possible by the new cars.
>
> The prolific fall of low-grade, corrosive matte imposes a duty on furnace connections and settlers probably without precedent in the practice of copper smelting. Means to cope with this condition have been devised, and the furnaces are no longer subject to the frequent interruptions by purely mechanical mishaps, which proved so embarrassing in the past. In the converter department, new steel silica bins were built and so placed as to permit feeding silica to the converters without resorting to the use of cranes.

Heat Losses in an Electric Steel Furnace were recently determined by W. H. Wills and A. H. Schuyler as being 12.5% through the door and tap hole and 7.3% through the electrodes (September meeting, American Electrochemical Society).

Mining & Metallurgical Machinery

Hamill Belt-Driven Ore Feeder

A new type of ore feeder is presented in the Hamill, the construction of which is shown in the accompanying illustration. Its moving parts consist of a short conveyor, or endless belt, intermittently propelled by a bell crank engaging a friction wheel on the headshaft. The bell crank is actuated either by a pulley and eccentric, on the belt-driven type, or by a fork-lever reaching under the tappet for the stamp-actuated type. As the bin gate can be left wide open and the ore flowing loosely to the



A VIEW OF THE HAMILL BELT-DRIVEN FEEDER

feeder belt, there is no bridging, blocking or crowding, irrespective of the size of the material. Coarse rock is fed as easily as fine material, and there are no idle strokes. By reason of this steady, regular delivery, the feeder is said to increase the capacity of stamps and other mills. It is adjustable while running, and can be set to longer or shorter stroke, or to nothing, independently of the speed of the driving pulley or rockshaft.

The machine is patented and is distributed by Edward Maag, 535 I. W. Hellman Building, Los Angeles, Calif.

Golden Glow Headlights

The Esterline Co., of Indianapolis, Ind., has been working to obtain a nonirritating light adapted to commercial uses and reflected in an intense but nondazzling beam, resulting in the Golden Glow mirror reflector. The ingredients used in making this glass are such as to give it a rich golden green, producing light as near the color of molten gold as it is possible to obtain.

There have been over 6,000 of these Golden Glow headlights in use in electric-railway and tunnel service, and in four years not a single accident has been recorded because of lack of light or inability to see the car approaching. A similar record should be obtained in mine properties, for the men ahead are not blinded or confused; miners can work in a seam at close range or at a considerable distance with equal ease, and in fog or dampness it provides protection not possible with any white light.

The "Simplate" Valve

To insure higher mechanical and volumetric efficiency and to simplify air-compressor cylinder design, the Chicago Pneumatic Tool Co., 1080 Fisher Building, Chicago, Ill., has recently placed on the market the "Simplate" valve, which is of the flat-plate design. The valve has several distinctive features and the chief advantages claimed for it are that it is simple; that its plates are independent in action, one of another; that each plate has

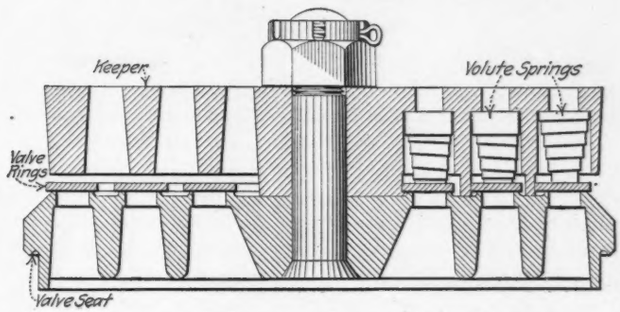


FIG. 1. "SIMPLATE" DISCHARGE VALVE

its individual springs; that the tensions of the springs on the inlet and discharge valves differ according to the density of the air handled; and finally, that it is applicable to all positions and conditions.

Fig. 1 shows a section through a discharge valve. The seat is cast from a special alloy steel, heat-treated, oil-tempered and ground true on one side. As shown in the

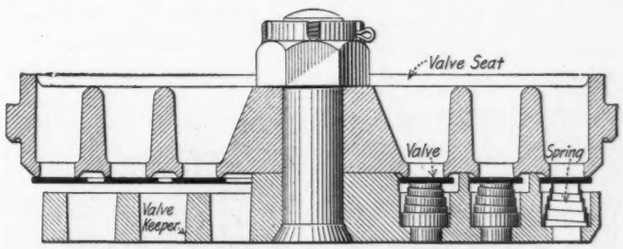


FIG. 2. "SIMPLATE" INLET VALVE

illustration, the seat has circular ports and it is machined so that the raised portion, or the point on which the plates rest forming the joints, is narrow, thus reducing the unbalanced area of the valve. The keeper is of the same material. It is provided with suitable ports for the free passage of the air through it and also furnishes guides for the valve plates and pockets for the valve springs. The latter are of the volute type and are made of high-grade crucible steel. The valves are simple concentric steel plates of uniform section, with a separate and independent plate over each port. Each plate is independently governed by its own spring, hence the action or opening

of each valve is entirely independent of the other. Should one of the plates open, the next one to it does not need to move unless the speed conditions should demand it. Ordinarily the outer plate opens when the compressor is running at slow speed, when running at intermediate speed two plates operate, and at full speed all valves are

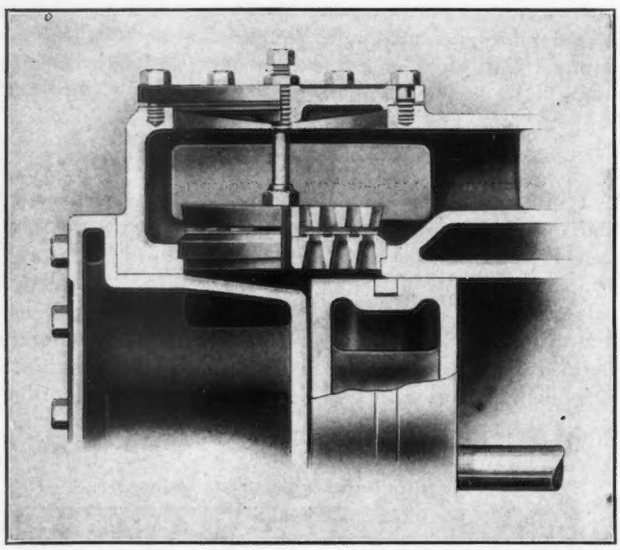


FIG. 3. POSITION OF VALVES IN AIR CYLINDER

open. The parts making up a complete valve are assembled and held together by a nickel-steel stud and castle nut, and when this nut is tightened in place it is held by the cotter pin.

As shown in Fig. 2, the construction of the inlet valve is similar to that of the discharge valve. It differs in that the keeper is thinner and the springs have lighter tension. On account of this difference in thickness, inlet and discharge valves cannot be reversed. The spring tension on the inlet valves is light in order to derive the full benefit of the various openings of the different plate when the piston speed is changed. For example, with an inlet valve of the size shown herewith, the spring tension is so calibrated that the outer plate opens with a pressure of but ¼ oz. per sq.in., while 1 oz. will open the intermediate plate and 2½ oz. the inner plate. The valves are said to be noiseless in operation, and their

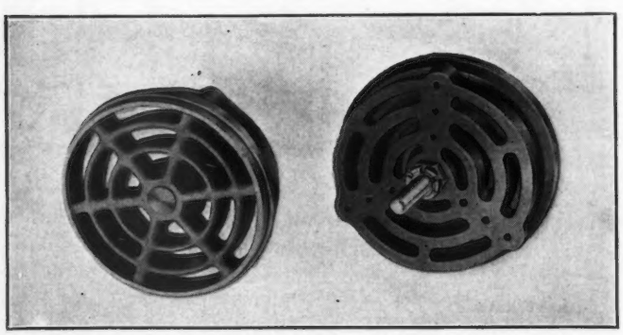


FIG. 4. THE "SIMPLATE" VALVE

location in the cylinder is convenient for examination or repair, as indicated in Fig. 3. Top and bottom views of the valve are shown in Fig. 4. It is equally suited to high- and low-pressure work and requires no lubrication. A feature worth noting is that all valve parts are interchangeable.

Gasoline Shovels Auxiliary to Steam Equipment

There are localities where smoke ordinances, the cost of coal and water or the demand for licenses for firemen and engineers prevent the use of steam shovels and make advisable the employment of those driven by gasoline power if certain handicaps of the latter can be overcome. The gasoline shovel therefore has been designed to satisfy a certain limited demand, rather than to produce a machine in competition with the steam shovel. Gasoline shovels will probably be restricted to medium and light excavation.

Several designs of gasoline-power shovels have been brought out recently, among which is that of the Marion Steam Shovel Co., of Marion, Ohio. The following notes on the equipment and operation of this type have been obtained from the company.

The Marion design has been developed only in the revolving type. All operations are performed by power from one engine and the operation is controlled by friction

FIG. 1. REVOLVING SHOVEL WITH GASOLINE-ENGINE DRIVE

clutches of the outside-band type. The engine is a constant-speed, four-cylinder, four-cycle vertical marine type with a throttling governor, jump-spark ignition and high-tension magneto. It is splash-lubricated and has a cooling-water pump. A flywheel is carried between the engine and the load to relieve the crankshaft of stresses due to sudden changes in torque. Any fuel can be used down to that of 39° Bé., provided the proper carburetor is employed.

On the end of the engine shaft is a bevel pinion which meshes with two bevel gears loose on a reversing shaft (*A* in accompanying view). One or the other of these is connected to the shaft by friction clutches. Placing the lever for operating these clutches on center will release both clutches. Geared to the reversing shaft is the hoisting drum *C*. This is of differential or stepped type, instead of the usual straight barrel seen on steam shovels. This scheme is employed to give greater pull and slower speed on starting the dipper out of the pit and an increased speed with lighter pull when the dipper clears the bank. In this way the difficulty of using a constant-speed drive is minimized. Forward of the hoisting-drum shaft and connected to it by an intermediate shaft *E*, with gears, is a pair of reversing gears with friction clutches—an arrangement similar to that on the main reversing shaft just mentioned. These control the crowd-

ing of the dipper handle, and are both governed by a single lever arranged so that when in central position both frictions are released and a brake *G* is set to hold the dipper handle in any position. Meshing with the reversing bevel gears on the intermediate crowding shaft is a bevel gear on a shaft *H*, running at right angles and having telescopic joints connecting to the crowding gear on the boom. This allows for variation in height of the boom.

The propelling of the shovel is done from a friction clutch and gear *J* mounted on the end of the hoisting-drum shaft. The gear meshes with another gear keyed to a horizontal shaft running directly over the rotating center. Here the shaft carries a bevel pinion, which engages with a bevel gear on the vertical propelling shaft, the lower end of which drives the shovel exactly as on the same manner. The gasoline shovel is a one-man machine—the elimination of the boiler makes a fireman unnecessary. It is not necessary for the operator to leave the shovel levers to look after the engine.

The gasoline type of shovel can be converted into a single-motor electric shovel by the substitution of an electric motor of the proper capacity in place of the gasoline engine. With the control gearing described a constant-speed alternating-current motor may be employed.—*Engineering News.*

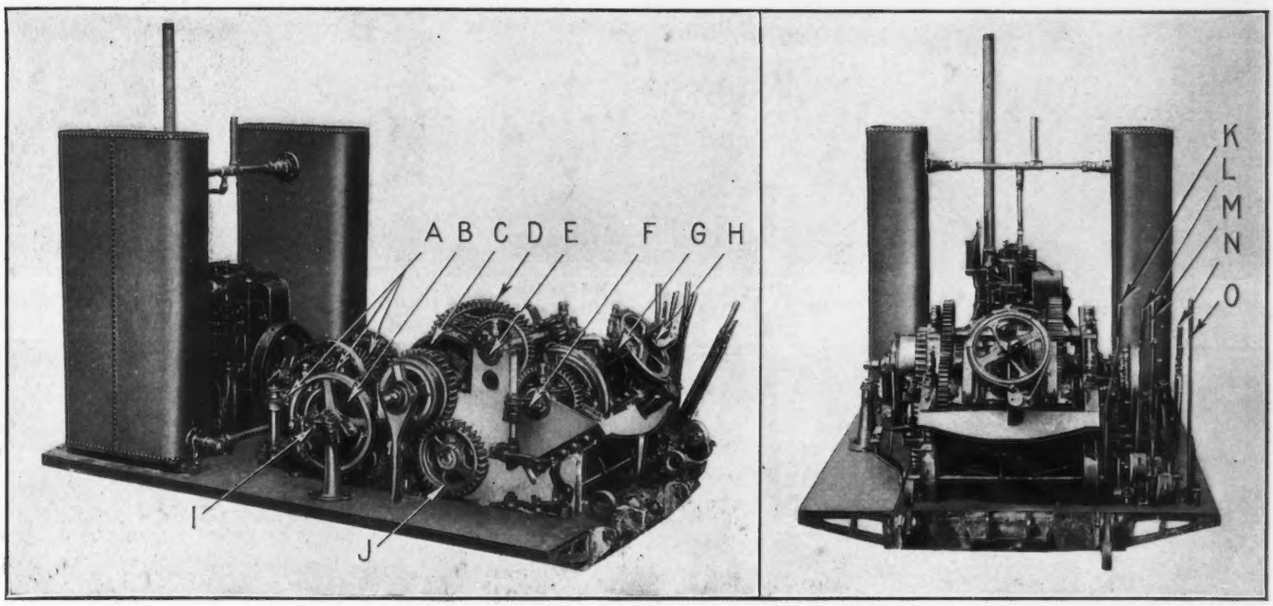


FIG. 2. TWO VIEWS OF POWER AND GEARING UNIT OF A MARION GASOLINE SHOVEL

the steam type. Reversing the drive is done at the main reversing gears already noted.

The shovel is swung by a spur gear carried on the main reversing shaft. This gear engages a corresponding spur gear fixed on a swinging shaft *I*, each end of which has a drive-wheel keyed to it and a corresponding friction housing *B*, which is keyed to a gear mounted loosely on the same shaft (with bronze bushings). Both of these gears on the swinging shaft are controlled by outside band frictions, duplicates of those on the reversing shaft; each gear engages another gear keyed to a short shaft below and forward. At the outer end of each short shaft is a bevel pinion meshing into a swinging crown gear on a vertical swinging shaft. The other end of each of these last shafts, exactly as on a steam shovel, carries a spur pinion meshing with a large rotating gear on the lower frame of the shovel. Since there are two swinging mechanisms between the bull wheel and the intermediate swinging shaft, the shovel can be turned in one direction or the other, according as one gear or the other on the intermediate shaft is engaged.

The operator's control of the gasoline shovel is kept identical with that of a corresponding steam shovel; the operating levers have the same position and work in

National Matheson Joint Pipe

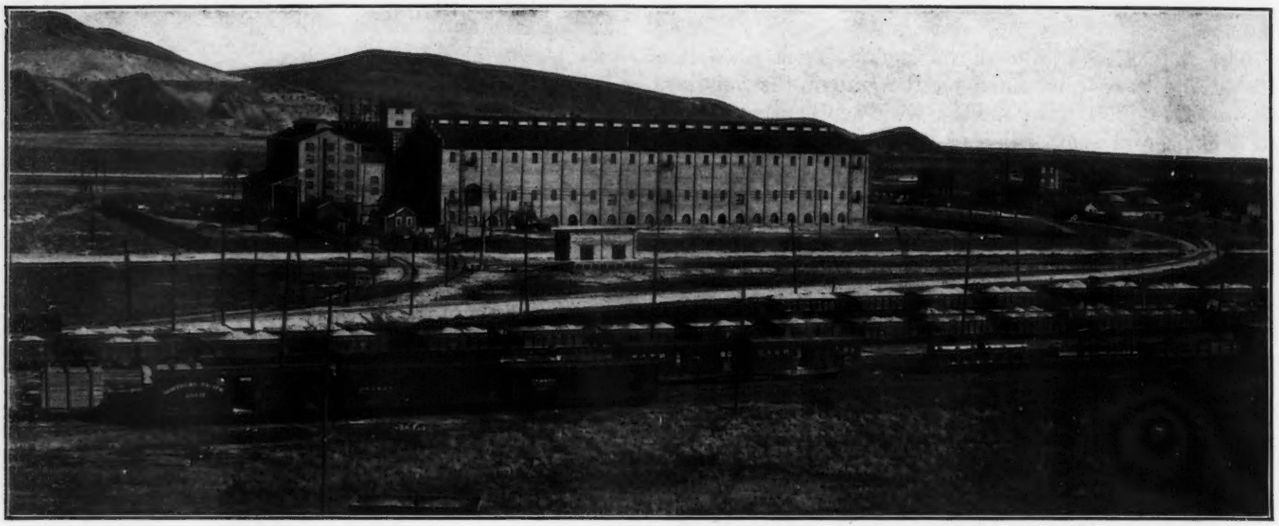
In a recent bulletin on Matheson Joint Pipe, the National Tube Co. calls attention to the following: "There is no economy in laying cheap pipe. Its life is too short. There is great inconvenience and disturbance in taking up a long flow line and replacing it with new pipe, and the first cost of the temporary system is practically thrown away."

It is claimed that National Matheson Joint Pipe has been in use from British Columbia to Mexico for periods as long as 30 years, in earth impregnated with alkali, sulphur and arsenic, and is still almost as smooth inside and out as when first laid.

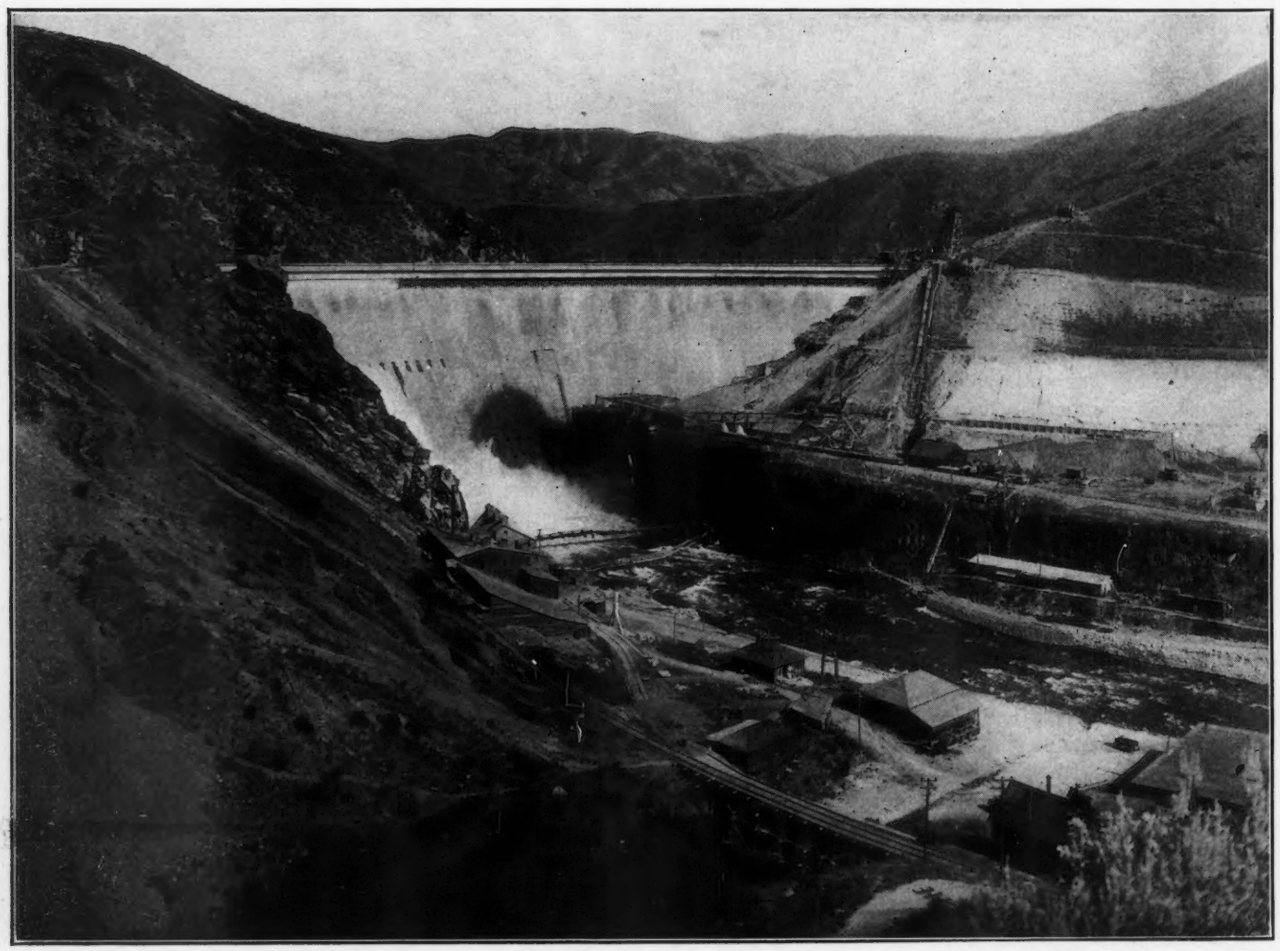
Asbestos-Protected Metal Skylight Construction

A form of puttyless skylight construction is being introduced by the Asbestos Protected Metal Co., of Pittsburgh, Penn. The glass is held between asphalt cushions, protected by asbestos felt above and below, and the entire joint is shielded above by a protected-metal cap and below by a protected-metal gutter that drains off any condensation water. In sawtooth construction or continuous monitor sash, the condensation gutter is omitted. The caps form a convenient support for the window cleaners' boards, which do not touch the glass.

Photographs from the Field

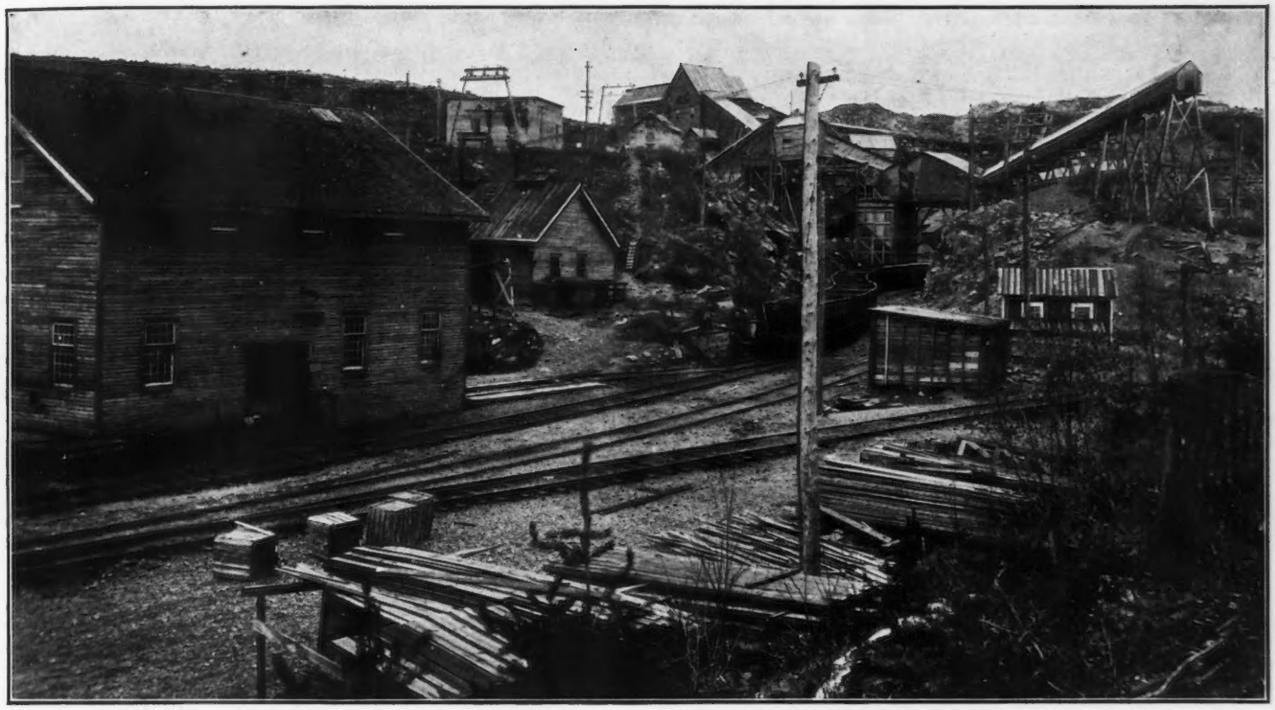


ANACONDA COPPER MINING CO.'S ACID PLANT AT ANACONDA, MONT., SHOWING BRICK PLANT NO. 2 AT THE RIGHT



THE ARROWROCK DAM, NEAR BOISE, IDAHO; THE HIGHEST DAM IN THE WORLD

Construction was completed on Oct. 4, 1915. It is on the Boisé project of the United States Reclamation Service, is 348.5 ft. above bedrock and 250 ft. above river bed. About 530,000 cu.yd. of cyclopean concrete was used



VIEW OF SURFACE SURROUNDINGS AND EQUIPMENT AT NO. 1 PLANT OF MOOSE MOUNTAIN, LTD., SELLWOOD, ONT.

INTERIOR VIEW OF THE MOOSE MOUNTAIN, LTD., MILL, SELLWOOD, ONT., SHOWING THE REGRINDING MACHINERY

The Alaska Gold Mines Co.

Rumors have been current that all is not well with the Alaska Gold Mines Co., operating in the Juneau District, Alaska, which rumors have been recently reflected in the stock markets, especially that the ore is not turning out so high as expected. Referring to this, D. C. Jackling informed the *Boston News Bureau* that an unexpected occurrence of low-grade schist was encountered on the fifth level, from which point it had been hoped to draw high-grade ore with which to sweeten the lower-grade ore being mined near the surface. Strangely, not one of the many drill holes cut into this low-grade intrusion. It is estimated that three or four months will be required to remove this material and put the mine in shape to supply average ore to the full capacity of the mill.

Up to the end of October the new mill had treated about 900,000 tons of ore, assaying about $1.25 per ton instead of the expected $1.75 per ton. Ore is now being mined and milled for 60c. a ton, and the tailings are assaying only 20c. per ton. At present the company is treating about 5,000 tons of ore per day, and it is expected that by the first of next year the rate will be about 7,000 tons.

Copper Supply of Great Britain

The following is from the *Statist* of Oct. 23, 1915:

As regards copper, it may be pointed out for the benefit of the uninitiated, that the metal resulting from the smelting of ores contains impurities that have to be removed before the copper is suitable for commercial use. There are two ways of refining this rough copper, one being by passing the metal through the furnace again and the other by treating it by an electrical process that dissolves the rough copper and redeposits it in a pure form, the impurities sinking to the bottom of the tank. By the first process any gold or silver contained in the rough copper is lost, but by the second process it is recovered, hence refiners have more and more favored the electrolytic process to the disadvantage of the furnace treatment. Now British refineries are mostly of the furnace type, treating rough copper and converting it into Best Selected. On the other hand, the American refineries are mainly of the electrolytic variety and produce the well-known electrolytic copper. Each of these coppers has its special spheres of utility, "Best Selected" being mainly used in the brass trades, while "electrolytic" is used largely for the manufacture of electric wire, etc.

It has been a grievance with the British copper refiners that the government did not patronize their product more extensively. They allege that years ago leading government departments buying copper were unduly influenced to favor American electrolytic at the expense of British Best Selected, and that they, moreover, were induced to fix so high a specification for Best Selected that it became most difficult to conform to it, the result being that the supply was much less than need have been the case, while the government bought more American electrolytic copper than it need have done. Even within the last few months we have seen large quantities of rough copper shipped from here to America under special permit for refining by the electrolytic process, the resulting copper being brought back to this country, and the British makers of Best Selected have got restive because they want the rough copper themselves. There is no doubt that as a commercial transaction the purchase of rough copper here at the very cheap prices that were paid for it and its conversion into electrolytic in America were thoroughly justified, but the British refiners feel that they are being unfairly treated by this cutting off of the supplies upon which they rely for carrying on their operations, and they think, too, that the mere process of transferring copper from here to America in this way tends still further to increase the power over the market which American producers wield. They are, therefore, making protests in official quarters with a view to some alteration in this respect. It should be remembered that the copper that has been shipped to America in this way has not been shipped by producers, but by people who have bought it in the open market, and who have been able to make a handsome profit on the transaction. The British refiners, however, suggest that a much more satisfactory state of affairs can be brought about if the government require all Empire-produced copper to be refined in Empire-owned refineries.

As will be seen from the foregoing, Australia has already resolved that her copper shall be refined locally, and thus within the Empire, and an extension of this principle to cover all Empire-produced copper would have a large influence upon the world's copper trade. For years past a considerable portion of Australia's production of rough copper, for instance, has been sent to America to be refined, and naturally every extra ton that is placed under the control of American producers tends to strengthen their already powerful position. During recent years America has been stretching her tentacles further and further, until she has practically controlled the copper-refining industry of the world, and any step which our colonies can take to put an end to this supremacy is worthy of whole-hearted support. America, of course, has been able to pay more for rough copper, too, than British refiners, because by the electrolytic process the bullion values have all been recovered.

Apparently it has been nobody's business to insure that British copper was reserved for British use, and it has required a world-wide war to force home economic and commercial lessons. If we in England are still asleep, it is a matter for national thankfulness that the colonies are awake, but the British refiners should bestir themselves and get their houses in order for the new state of things that will come when the war is over.

Revision of Mining Laws

The convention of mining men of the United States, who will meet in Washington, Dec. 16, by invitation of the Mining and Metallurgical Society of America, will be held in the auditorium of the National Museum, the use of which has been granted through the courtesy of Dr. Charles D. Walcott, director of the Smithsonian Institution.

All of the mining societies of the United States have been invited to send delegates to this convention, and through the United States Bureau of Mines all of the mine operators of the country have been notified and invited. Much interest in the meeting is being exhibited.

According to the tentative program, the first session will be held at 10 a.m. and other sessions at 2 p.m. and 8:30 p.m.

Japan's Mineral Output in July

The production of important minerals during July, 1915, in Japan, is reported by the Imperial Mining Bureau as follows: Gold, 557.089 kg.; silver, 10,847.955 kg.; copper, 5,385.453 metric tons; iron, 3,731.433 metric tons; coal, 7,409,052 metric tons; crude oil, 44,299,440 liters; and sulphur, 6,607.762 metric tons. Gold, silver, copper and oil showed increases and iron, coal and sulphur, decreases, as compared with the same month of 1914.

The Altai Railway Opened

Traffic on the Altai Railway, in Central Asia, says a Petrograd dispatch to the London *Times*, will open Nov. 4, fourteen months earlier than the date contemplated. The railroad, a private line 500 mi. long, will open up an immense and rich region of Siberia that hitherto has been without means of communication.

Chinese Currency-Reform Schemes have been so numerous that the latest one is perhaps to be accepted with some doubt. Under this silver coins are to be minted as follows: 200,000,000 one-dollar, 80,000,000 fifty-cent and 235,000,000 ten-cent coins. Copper, 275,000,000 twenty-cash (two-cent) coins, 858,000,000 ten-cash and 186,000,000 one-cash coins. This coinage is to be spread over 10 years.

Correspondence and Discussion

New Mining Taxes in Mexico

In Mexico the government divides the year, not into quarters, but into thirds, or *tercios*. The fiscal year begins July 1. The unit of mining field is the pertenencia, which measures a hectare (100 meters square) and is equal to about 2.4 acres.

The old Spanish mining code required properties to be worked, and to promote the industry it charged a light license or title fee and no yearly tax on the property. Instead, it taxed the gold and silver produced with a coinage or mining tax. All gold and silver exported had to pay this coinage tax. In the late '80s of the last century taxes were charged by the federal government of Mexico, as follows: Minting or export duty, 4.41%; interior revenue duty (3c. on each $5), 0.60; state duties, 1.50; federal supertax on the state duties, 0.45; stamps and assaying charges, 0.25; total, 7.21%.

In 1892 the mining law was revised and again in 1905. All old titles had to be renewed. The later law required all titles to carry internal-revenue stamps to the amount of 5 pesos per unit of mining field and further imposed a property tax on each individual mining property of 6 pesos per unit of mining field (pertenencia) up to 25, and 3 pesos per unit on the excess over 25 pertenencias.

In many ways the new mining law was an improvement on the old one, but silver mining, which had been Mexico's principal mining industry, did not flourish as well as had been expected. The price of silver was falling, and many properties of the old mining districts had to stop operations. New York quotation for silver in 1876 was $1.156; 1882, $1.136; 1887, $0.978; 1892, $0.871; 1897, $0.604; 1902, $0.522; 1907, $0.63.

It therefore was found necessary to reduce the production tax to 2½% federal export tax and 1½% state tax, plus 20% federal addition, and it stood at this figure until it was changed on Mar. 1, 1915, by decree of Carranza, which raised the title tax, or license, the property tax and the export tax. Objections were of course made by property owners, and the matter was brought to the notice of the Department of State in Washington.

On June 30, 1915, the Department sent a vigorous protest to its special representative, Mr. Silliman, in Vera Cruz, calling the attention of General Carranza to the pitiful condition of the mining industry in general and the foreign-owned properties in particular, and asking that protection be given to foreign interests holding and operating mines, and further that no more taxes be imposed "other than those fixed by the laws emanating from the constitution."

This brought from the Carranza government the following statement or argument, which, if it is to be taken seriously, gives an idea of certain Mexican revolutionary conceptions and ideas:

MEMORANDUM OF THE SECRETARY OF THE TREASURY (SECRETARIO DE HACIENDA) ON MINING TAXES

Translation by W. C. Thurston

In conformity with the laws of Mar. 25, 1905, mining properties paid taxes as follows:

Up to 25 pertenencias, 2 pesos Mexican gold per pertenencia per tercio (period of four months), or 1 dollar per tercio, ¼ dollar per month.

From 25 pertenencias up, 1 peso Mexican gold per pertenencia every 4 months, or ½ dollar per tercio, or ⅛ dollar per month.

The exchange on New York from 1908 to 1912 reached an almost invariable point very close to ½ dollar per peso.

The decree dated Mar. 1, 1915, fixes the following taxes:

Up to 10 pertenencias, per tercio per pertenencia, 4 pesos Mexican gold, or 1 peso Mexican gold per month, or ½ dollar per month.

Up to 20 pertenencias, per tercio per pertenencia, 5 pesos Mexican gold, or 1.25 pesos Mexican gold per month, or ⅝ dollar per month.

Up to 50 pertenencias, per tercio per pertenencia, 6 pesos Mexican gold, or 1.25 pesos Mexican gold per month, or ⅝ dollar per month.

Over 50 pertenencias, per tercio per pertenencia, 8 pesos Mexican gold, or 2 pesos Mexican gold per month, or 1 dollar per month.

The decree dated Aug. 31, 1915, modified the above taxes temporarily, and only for the two tercios included between the months of July of this year and February next, as follows:

From July to October, per pertenencia, whatever be the number, 2 pesos Mexican gold, or ¼ dollar per month.

From November, 1915, to February, 1916, per pertenencia, for whatever be the number, 2.66 pesos Mexican gold, or ⅓ dollar per month.

From Mar. 1, 1916, the tax rate above mentioned as fixed in the decree of Mar. 1, 1915, will resume effect.

The law of 1905 favors monopoly, imposing upon the small properties (up to 25 pertenencias) double the tax paid by the large properties (over 25 pertenencias).

The law of Mar. 1, 1915, aims at a different purpose; that is, to favor the small properties, imposing lower taxes upon them than upon the large properties. This tendency is perfectly justified and is sanctioned by the proceedings of all civilized governments.

The decree of Mar. 1, 1915, imposes upon the large interests (over 50 pertenencias) double the tax levied on the small property (10 pertenencias).

The intermediate properties (between 10 and 50 pertenencias) pay an ascending proportional rate.

In conformity with the income-tax law effective in the United Sates, the small interests, with annual profits of less than $20,000, pay 1%; those whose profits are $50,000 pay 2%; up to $75,000, 3%; and so on successively to 7%, paid by those whose profits are more than $500,000 per year.

So it is seen that the large enterprises in the United States pay proportional taxes seven times greater than those paid by the small enterprises.[1] In conformity with the mining law which will commence to operate next March, the large properties (50 pertenencias) will pay only double the amount of taxes paid by the small properties (10 pertenencias).

As is seen, the progressive increase in the mining tax is very moderate when compared with the income tax.

Comparing the tax fixed by the new law for the small property with the old tax, it is seen that it is doubled, but this by no means indicates that it is a high one, because the old tax was exceedingly low.

A tax of ½ dollar per month per pertenencia cannot be called high, and ½ dollar per month is the amount that will have to be paid, beginning in March of next year.

There are some concrete cases which may be cited, of mining companies having more than 100 pertenencias denounced in one single mining district, and in some places they have been paying mining taxes during 15 to 20 years without doing one stroke of work on the ground denounced. The progressive tax tends toward eliminating these unjust and unproductive monopolies.

Some mine owners, attempting to show that the taxes are very high, argue by reducing to paper money the value of gold and comparing this to the amounts formerly paid by them when exchange was ½ dollar for one peso. This cannot be taken seriously, nor is it worthy of consideration. The

[1]Not true. The income supertax is levied on individuals, not on corporations.—Editor.

comparisons should be made between what they pay in gold and what they paid in the same money.

The only weighty argument thus far presented by those interested in the reduction of the taxes is that the great majority of mining interests have had to stop their work entirely or partially because of the European war and the state of intranquillity prevailing in this country. Precisely because this reasoning was considered just, the decree of Aug. 31, 1915, was issued, reducing considerably the rate of taxation without making the progressive increase, for the two tercios between July, 1915, and February, 1916.

The interested mine owners also call unjust the act that the taxes are collected in gold and not in paper money. They are not justified. For a long time export taxes, the stamp tax (that is, the revenue tax) on petroleum, forest exploitation, etc., have been collected in gold, and gradually it will be decreed that other taxes be paid in gold, until all fiscal collections will be made in this class of money.

This fiscal program of the government, tending to consolidate the monetary system, can in no way be called unjust. The business concerns that produce articles for exportation can object less than any other to paying their taxes in gold. These concerns sell their product for gold, but, on the other hand, pay a great part of their running expenses in paper money. Therefore they would be absurdly favored if they paid their taxes in paper money.

SPECIAL REPRESENTATIVE'S REPORT TO WASHINGTON

Vera Cruz, Sept. 13, 9 a.m.—To Secretary of State, Washington. Department's Sept. 11, 4 p.m., regarding mining taxes, Mexican Government's argument is:

First—Mining taxes have always been disproportionately low; with present depreciated currency they would be so absurdly low as to be entirely inequitable.

Second—In view of depreciated and fluctuating paper currency, the only proper and equitable unit is the Mexican gold peso, equivalent approximately to 50c. American.

Third—It is not inequitable that a product produced by labor paid in depreciated currency and sold for gold should pay its government taxes in gold.

Fourth—It is not unusual for paper currency to be of enforced circulation for the payment of public and private debts and at the same time be declared not legal tender for government taxes.

Fifth—The government's intention is to increase its revenue from productive mining properties, but not to the extent of embarrassing them or of confiscating properties that are not productive or that are undeveloped.

Observations—Inasmuch as the government has modified the decree of Mar. 1 and has expressed its willingness to deal with the owners of mining properties upon representation, it is respectfully suggested that the owners of mining properties take up their cases directly with the Secretary of Hacienda either through a commission from a given locality or by individual owners in person or through correspondence.—Silliman (State Department's Special Representative).

The Mexican argument refers only to the property tax and does not mention the tax on the product, which is by far the heavier burden on operating properties. In the argument every large business is considered a monopoly, and it holds that it is better and more just that the mining properties be divided into small units because some large properties have not done work for a number of years. It calls the aim of the new decree to bring this about "perfectly justified and sanctioned by the proceedings of all civilized governments." It therefore legislates against the principle of coöperation, association and concerted action. How a federal government promoting such principles can expect to promote modern industry or even to maintain itself is not indicated.

Evidently, in the hurry to collect taxes from those that still had property, the principles of taxation were twisted to suit the circumstances. This is shown by using the United States income tax, a tax on net profit, as a rule and guide for a tax on property, which is a totally different matter. Property may or may never produce income, and an income tax is not a tax on property, any more than is an inheritance tax.

Mine operators in Mexico will have to show and will have to convince the Carranza government that the new decree cannot possibly bring about a permanent increase in revenue, but that on the contrary, it would injure the industry and would in many cases make successful mining impossible. The yearly federal tax on mining property in Mexico is only a small part of the taxes the miner has to pay. The tax on production has always been excessive; it now has been made exorbitant and prohibitive, but this production or export tax is ignored in the argument of the Carranza government. Together with the state tax, it would be 10% on the assay value of the gold and silver produced, which most mining companies are unable to pay. It would stop production.

Mines may now and then be worked by individuals, but they will never give occupation to a mining population unless they are worked on a large scale, with sufficient capital to guarantee a steady production. This is generally beyond the scope of the individual. Capital has been invested in mining in Mexico judiciously or injudiciously, but always with faith in the permanency of existing laws after careful study of the same. To increase suddenly the taxes and change the laws is grossly unjust, because it disorganizes the carefully laid plans on which the working results of future years depend. Capital would be scared away from the country by such proceedings.

Since the yearly federal tax on mining property in Mexico is only a small part of the federal tax which the miner has to pay, the tax on production being ever so much more burdensome, it is useless to compare this special tax with the amounts paid in other countries.

In Mexico the miner pays for his mineral right according to the amount of surface by which it is covered, whether the ground is valuable or not, whether his work is profitable or unprofitable, whether he works or not; and moreover, he pays on his gross production. In the United States he pays a tax on his profits. Corporations are charged 1% on their profits, but there is no Federal tax in the United States with which the Mexican federal mining tax can be compared.

In Mexico the state tax is 1½% plus 20% additional federal supertax, or 1.8% on the gross product, and on the two million dollars produced it would be $36,000, profit or no profit.

The state taxes in the United States vary in rates and in ways of assessment. In the State of New York, in general, corporations are assessed upon their capital, "existing in money or property." If the capital were $1,000,000 and the profit $1,000,000, or 100%, the state would tax ¼ mill on the capital for each percent. of dividends or 2½%, or $25,000, but if the profits amounted to 20% on a capital of $1,000,000, the tax would be $5,000; if 6%, $1,500; and if there were no dividend, $750.

It is not possible to mention here in detail all other taxes, such as municipal taxes and the high taxes which the miner has to pay in Mexico on the supplies brought from the United States or other foreign countries.

In answer to the statement of the Carranza government that the federal mining tax has always been disproportionately low and that the new tax of one dollar per pertenencia per month is a moderate one, what else can be said than that it may be one of the last straws, and that when they break the camel's back the rider may be on foot?

New York, Nov. 5, 1915. A. J. R.

Editorials

Anaconda's New Metallurgy

In the *Journal* of May 9, 1914, there was an article outlining a new and vast plan for metallurgical improvements that had just been inaugurated at Anaconda. In summarizing this it was remarked:

> When the Anaconda plan is fully carried out the tailings discharged from its mills will carry only 0.1 to 0.2% copper, against the former 0.65 to 2.2%. Instead of recovering only about 75% of the copper of the ore, the recovery is expected to be around 95% and, best of all, the additional copper will be got at far less cost per pound than the present copper. Without increasing its ore production the company can increase its copper production by something over 50,000,000 lb. per annum and reduce its cost on the whole product by ¾c. per lb. or so; or it can reduce its ore production; or it can mine a lower grade of ore when that be advisable. However the management determines to work the thing out, it will benefit enormously by the great step that it is effecting in the conservation of its resources.
>
> Its other economies are of course of the first order of importance—the compressed-air hoisting, the electrification of the railway, the remodeling of the Washoe concentrator, the reconstruction of the Great Falls smelting works and the abandonment of concentration at Great Falls, saving the high cost of freight to there. These ought to do much more than merely offset the increased cost of living which Anaconda experiences alike with other mining companies.

At the time when that article was written, the contemplation of the Anaconda metallurgists was to go into copper leaching on a huge scale, but their attention had just been drawn to the possible economic superiority of the substitution of the flotation process for mechanical concentration, and it was suggested that they stood ready to abandon the leaching feature of their program in part or in whole if that should appear desirable. In fact, things turned out so and only the leaching unit then under construction was completed, it fitting in well for a special purpose, while steps were taken to convert the main Washoe concentrator into a flotation plant.

Since then about 18 months have elapsed, and the program of improvement is now about 75 to 80% done—completion being expected by the end of this year—and the Anaconda management feels that it may safely begin to check up with the original estimates and make up its mind as to what is going to be accomplished in a commercial way.

In September, 1915, about 8,000 tons of ore daily was treated by the new process. Applying the data derived from that month to the production figures in 1913 and computing on the basis of 14c. per lb. for copper, it is reckoned that the saving would have been about 7¼ million dollars. Putting the thing in a different way, the gain of valuable metals previously lost in tailings and slag would have been 50,000,000 lb. of copper, nearly 1,000,000 oz. of silver and about 5,000 oz. of gold. Note the coincidence between these figures and those that the Anaconda metallurgists were talking about early in 1914.

The enormous saving is being effected at the cost of about $5,000,000 for new plant. In other words, the outlay of that vast sum of money will be repaid in about eight months.

Whence has this spectacular gain been derived? Primarily, chiefly and naturally from the concentrator. We say naturally, for the art of mechanical concentration has ever been the most imperfect of our metallurgical processes and an attempt to make a big saving was logically directed to that quarter. What has been accomplished there sounds almost fabulous. Formerly the tailings wasted from the mill assayed about 0.62% copper. Now they go only about 0.10%, and there is a reasonable expectation that even that small figure will be bettered. The Anaconda ore fed into the mill contains 60 lb. copper per ton, whereof only 1⅓ lb. now goes away with the tailings. The recovery in milling is therefore 97¾%. Nothing like that in mechanical concentration was ever heard of before. The statement that about two-thirds of the net annual saving will be made in the concentrator is therefore immediately comprehensible.

The other great items of saving are: (1) The improvement of the reverberatory-smelting process by the introduction of coal-dust firing—the daily furnace duty being 583 tons against a former 239 tons and the ratio of ore to coal being 6.95 : 1 against a former 3.96 : 1, besides which there is a reduction of the copper loss in the slag; (2) the abandonment of briquetting and blast-furnace smelting in favor of the new reverberatory process; (3) the saving in freight resulting from the direction of all the concentrating ore to Anaconda instead of sending some of it to Great Falls; and (4) the operation of the leaching plant.

Not the least remarkable thing in this great transformation was the skill with which everything was done without interfering with production, there having been no general shutdown of the plant, no diminution of the regular output. The alteration of the concentrator was done section by section, and so efficiently was this managed that the time of changing a section from the old style to the new was only 26 days.

Even before these changes at Anaconda were conceived, the metallurgical practice there ranked with the best in America and the improvement of it might have been regarded as an attempt to burnish fine gold. Anyway, most metallurgists would have been satisfied with what they were doing and would have waited until the prodding of competition forced them to think. Not so with the Anaconda staff. It will now have the satisfaction of knowing that it has won the greatest triumph in the annals of copper metallurgy and has put the Anaconda company into the ranks of the low-cost producers of copper.

Revision of the Mining Laws

Much interest is being manifested in the meeting of mining men to be held in Washington Dec. 16 under the auspices of the Mining and Metallurgical Society of America. Delegates from all parts of the United States have already signified their intention to be present. It is

hoped that the attendance will be large and representative.

The purpose of this meeting is to demonstrate to Congress that the men who are engaged in the mining industry of the United States want a reform of the archaic and discordant mining laws under which they have been operating for the last 50 years. That a reform is wanted by a great majority is undoubted. To be sure, there are some who say that the mining industry has thriven under the existing system and therefore it should be let alone, but the answer to this is that it has thriven in spite of the system and in most of our great mining camps the extralateral features of the law have been abolished by common consent, as also has been the requirement of discovery.

However, the purpose of the forthcoming meeting, as stated by the Mining and Metallurgical Society, is not to advocate specific reforms, not to attempt to draft a new law in convention, but to impress upon Congress the demand of the industry that something be done. The drafting of a new law ought to be the work of a commission, which will study the diverse conditions of our mineral deposits, hear the opinions of a great many people and coördinate everything for the general good.

This was recognized in bills that were introduced in the Senate and the House respectively last winter, largely through the instrumentality of the American Mining Congress. These bills were pushed far enough to have them reported out of committee, but amid the pressure of other business they failed of passage. The object of the forthcoming meeting is to give one of them, or an improved bill, the effective push that will set it rolling through the next session of Congress right into the President's office for signature.

Anaconda Produces Spelter

The Anaconda company is already turning out electrolytic zinc at the rate of 10 tons or so per day and is reported to be contemplating the erection of a great plant for this purpose at Great Falls, Mont., or some other place near hydro-electric power supply. Its initial production arrived at a happy time, the price for all spelters being phenomenally high, while high-grade spelter rivals tin in price.

The production of electrolytic spelter on a large scale has not been profitable heretofore. It may fall to the lot of the Anaconda company to tell a different story. There are several important things in its favor. The Butte zinc ore is of a character that permits a high extraction of zinc by sulphuric-acid lixiviation, the formation of zinc ferrite during the roasting being but slight. The ore is relatively high in silver, a large proportion of which is recoverable. Great Falls and other places on the Missouri River afford cheap electric power, which is produced by an allied company. Finally, the process is being developed at a time when profits are so big that they dwarf all infantile discouragements.

It will be interesting to find out what the Anaconda electrolytic spelter is going to run when the process is perfected. The electrolytic spelter produced by Brunner, Mond & Co. at Winnington, England—heretofore the only supply of this sort—is guaranteed 99.95% Zn. Using the relatively pure ore of Butte, Anaconda should be able to do as well, and probably will.

It is worth while to note that electrolytic spelter is now being produced at the rate of several tons daily by the Weedon Mining Co. at Welland, Ont., and some is also being produced by the Consolidated Mining and Smelting Co. at Trail, B. C. The Bully Hill Copper Co. in California has been working on this subject for a long time, and it also may become a regular producer ere long.

High-Grade Spelter

Previous to the war there was an official classification of virgin spelter as high-grade, intermediate, brass special and prime Western. High-grade spelter had to contain at least 99.9% zinc and intermediate from 99.5 to 99.9%, besides conforming to certain specifications respecting the contents of lead, iron and cadmium. The only high-grade spelter was the well-known Horsehead and Bertha brands, and there was but a limited market for them. By restricting the production to the relatively small demand a premium of about 2½c. per lb. was realized for these brands on the average.

Soon after the war began, an extraordinary demand for spelter of this kind arose, and in 1915 a price as high as 40c. per lb. was received, which was about 15c. per lb. above the maximum for prime Western. The classification of intermediate spelter was practically wiped out, a range of 0.5% in zinc content being too wide. Spelter assaying 99.8 to 99.9% zinc fetched one price, that assaying 99.7 to 99.8 another, and so on. In fact, there developed a market for high-grade spelter, for high-grade intermediate, for lower grades of intermediate and thus downward. Until recently the Horsehead and Bertha brands continued to be the only high-grade spelter, strictly speaking, although the high-grade intermediate was commonly referred to as such. Lately the Mascot brand, produced from Tennessee ore, has been put in the high-grade class by refinement of methods of production.

The high-grade intermediate spelter is produced by the smelting of ore selected for its purity—especially its freedom from lead—or by the redistillation of common spelter. In either case the impurity that is particularly difficult to control is cadmium. Most of the spelters that analyze about 99.85% in zinc are equal to the high-grade specifications in the matters of lead and iron, but are a little too high in cadmium.

Now whether cadmium is a deleterious element in spelter, or not, is a moot point, even with regard to a considerable proportion of it. For many purposes—even military purposes—it is inconceivable that 0.05% Cd, plus or minus, can make any great difference. Readers of the *Journal* may recollect a discussion of the subject of cadmium in spelter in these pages about 10 years ago, when some manufacturing experiments made by a well-known brass maker were referred to and the deduction was drawn that for ordinary brass cadmium is not a deleterious element. Since then Mr. Rigg and his colleagues in the New Jersey Zinc Co. have indisputably shown that cadmium—even in small proportion—is highly objectionable in spelter that is to be used for making slush castings. It is pretty well established, moreover, that for making cartridge brass the spelter should be as pure as can be obtained, for otherwise the cartridge cases deteriorate in course of time. The quality of the brass

is not apparently so important in the case of cartridges that are to be used soon.

Let the influence of cadmium in spelter be what it may, there is no doubt that military specifications have called for spelter much more highly refined than is necessary in many cases. However, discussion of this is purely academic. Some users of spelter have cadmium on the brain and are willing to pay 5c. or so per lb. of spelter for the difference between 0.1% Cd and 0.05% Cd, and the rational thing for zinc producers to do is to give them what they want and take their money. There is no use in arguing with them that they ought not to want what they think they do.

Whether it be high-grade spelter or high-grade intermediate, the preposterous premium had the natural effect of stimulating the production of those kinds, and of course, the additional supply will sooner or later reduce the premium. Of late these sorts of spelter have not been so readily salable as they were a little while ago. Some of the producers, averse to recognizing any change in the conditions and hopeful that they will once more be able to sell their product at the price for tin, are holding it back. Such accumulation of unsold spelter as is now believed to be taking place is supposed to be chiefly of these kinds. One of the reasons for the sustained strength in the market for prime Western is the diversion of so large a proportion of it to the manufacture of refined. The advent of new producers of superior spelter will naturally hasten the correction of the disparity in prices that has existed for so many months.

Anti-Alien Laws Declared Unconstitutional

The Supreme Court of the United States decided last week that the Arizona Anti-Alien Labor Law is unconstitutional. This is the law passed recently in Arizona, which prohibits employers of labor from having among their employees more than 20% of persons not citizens of the United States. The Supreme Court decided that it is in contravention of the Fourteenth Amendment. How emphatic is the stand of the court is shown by the following from Justice Hughes' opinion:

> It requires no argument to show that the right to work for a living in the common occupations of the community is of the very essence of the personal freedom and opportunity that it was the purpose of the Fourteenth Amendment to secure. If this could be refused solely upon the ground of race or nationality the prohibition of the denial to any person of the equal protection of the laws would be a barren form of words.

If the Arizona Anti-Alien Law had been upheld, the effect upon the mining companies of that state would have been very serious. However, nobody was ever much worried about it, the intelligent opinion having been from the beginning that the law was unconstitutional and would be nullified by the Supreme Court.

The Department of Justice has appealed to the Supreme Court in the case of the United States Steel Corporation. It thinks that the Circuit Court was mistaken in the decision that the Steel Corporation is not a combination in restraint of trade; also in the decisions respecting other matters. In the meanwhile the Department of Justice is alleged to be looking with suspicious eyes upon the Bethlehem Steel Co., Pennsylvania Steel Co., Cambria Steel Co., etc., among which one or two combinations are supposed to be impending. These companies are believed to have become so big and prosperous that the public may have to be protected against them. This notion does not, however, harmonize with the idea still entertained regarding the Steel Corporation.

BY THE WAY

The *Wall Street Journal* recently commented on the alleged ability of the ground hog to foretell an early or late spring on his first emergence from winter retirement and opines that Wall Street is not without its ground hog. This sagacious animal, resident in Massachusetts, comes out of its burrow from time to time and looks over the financial sky, eventually making a noise which sounds like "coppers." When this noise is heard one may know that a bull market is nearly over. The animal's name is supposed to be thomaswlawson.

The sixth arrest in the alleged plot to dynamite ships leaving New York with munitions for the Allies was made on Nov. 1. The last prisoner is stated to be "Engelbert Bronkhurst, mining engineer and explosives expert." According to the reporters he is 52 years old, speaks seven languages, and is the most striking looking person in the alleged conspiracy. He was born in Hanover, Germany; won a degree in mining engineering; served in the army; worked in the South African diamond mines; came to this country and worked in the mines in the West and Southwest, and spent several years in South America.

In the good old days of 25 years ago, in order to attract money into an alleged gold mine it was only necessary to display a truck load of the quartz in some City shop window, according to the London *Financial News*. Gaping crowds gathered around, feasted their eyes upon the unwonted sight and then hurried off to apply for shares. In one case, the *News* continues, a truck load of quartz had been utilized in this way and there was an overwhelming subscription for the shares. The amateur board of directors wished to justify its existence and immediately after allotment cabled the manager to commence crushing. He replied, also by cable, that he could not commence crushing until the reef was sent back to him from London.

General Francisco Villa, according to the New York *Times* of Nov. 1, arrived at the international border, and announced that he intended to attack the Mexican town of Agua Prieta regardless of any action United States troops might take. "If necessary I will fight the United States army assembled along the border," he said. When he learned that General Carranza had been permitted to transport reinforcements over American territory he said: "This is the way the United States repays me for the treatment and protection I have given foreigners in Mexico. Hereafter I don't give a —— what happens to foreigners in Mexico or in my territory. I am through with the United States. I can fight my battles. Let them fight theirs. I can whip Carranza and his entire army, but it is asking a great deal to whip the United States also, but I suppose I can do that, too." Hully gee!

Accidents in Metallurgical Plants in 1913 and 1914

The first report of the United States Bureau of Mines on accidents at metallurgical works has just been issued by the bureau and includes the calendar years 1913 and 1914. The figures, compiled by Albert H. Fay, engineer, show that 119 men were killed during the two years, 2,285 seriously injured and 11,046 slightly injured at smelting plants and mills, representing fatality and injury rates of 1.55, 29.67 and 143.44 respectively per 1,000 men employed per year. The report includes the returns of 79 smelting plants in 1913 and 94 in 1914, including copper, lead and zinc, and quicksilver smelteries, as well as refineries. The iron blast-furnace figures are not included. The number of ore-dressing plants in 1913 was 311 and in 1914, 484. These represent concentrating plants of copper, lead and zinc ores, stamp mills, cyanide plants and iron-ore washers.

The total number of men employed in the metallurgical plants cited, both smelteries and ore-dressing plants, was 35,549 in 1913 and 41,461 in 1914.

In the ore-dressing plants machinery was responsible for 25.6% of all fatalities, 28.9% of the serious injuries and 16.5% of the slight injuries. Similar figures for smelting plants are much smaller, for the reason that there is more machinery in use in ore-dressing plants than in smelteries, and the men are usually in closer contact with the machinery; as, for example, at jigs, tables, stamps, rolls, and crushers. There are many revolving shafts, a large number of which have projecting keys, moving belts, wheels and cams within the reach of the operator. The machinery at smelting plants is usually confined to the power house, where the blowers, engines and dynamos are placed, and to overhead cranes, most all of which are entirely out of the reach of the regular employees.

The percentage of accidents caused by "falls of persons" and "flying and falling objects" is 15.4% apiece in ore-dressing plants, whereas at the smelteries the fatalities due to falls of persons represent 20% of the total and those due to flying or falling objects represent 5%.

Haulage systems claim 25% of the fatalities at smelting plants and about half this percentage at ore-dressing plants. The difference is due largely to the type of material handled and to the greater number of cars in operation around smeltery yards than at ore-dressing plants. In many ore-dressing plants the ore is brought to the bins in railroad cars or aërial trams, and often there is no other haulage system in connection with the plants, the tailings usually being disposed of by launders or flumes; whereas at smelting plants the molten slag is handled in slag cars and the bullion has to be handled on trucks.

At smelting plants burns from hot metal, slag, etc., claim the largest percentage of serious and slight injuries and 11.3% of the fatalities.

The tables presented will serve to call attention to the principal causes of accidents at these works and should serve as guides for the safety engineer to show where it will be possible for him to do his work most efficiently and to accomplish the best results. Little has been written on the subject of metallurgical accidents, other than for the iron and steel industry, and statistical information is far from being complete. Certainly the above figures can be bettered. One man injured in every seven employed each year is too high.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

LABORATORY TABLE. Emil W. Schmeling, Rockford, Ill. (U. S. No. 1,158,305; Oct. 26, 1915.)

LADLES—Improvements in Nozzles and Stoppers for Steel Ladles and the Like Appliances Connected Therewith. P. W. Fawcett and F. Batty, Sheffield, Eng. (Brit. No. 22,746 of 1914.)

LEAD—Machine for Casting Lead Pigs. John Forsyth Miller, Trail, B. C. (U. S. No. 1,157,794; Oct. 26, 1915.)

LEAD AND ZINC—Process for the Industrial Separation of Lead and Zinc Contained in the State of Sulphides in Ores. Guy de Bechi, London, England. (U. S. No. 1,157,153; Oct. 19, 1915.)

METAL COATING—Method of Melting and Spraying Fusible Substances. Franz Herkenrath, Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co., of America, Boston, Mass. (U. S. No. 1,157,984; Oct. 26, 1915.)

METAL RECOVERY—Improved Process of Recovering Metals From Ore. New Metals Process Co., Chicago, Ill. (Brit. No. 17,324 of 1914.)

MINE-CAR BRAKE. Henry Dow Scott, Sheridan, Wyo. (U. S. No. 1,155,964; Oct. 5, 1915.)

MINE TAILINGS—Slime Thickener for Dewatering Mine Tailings. Wilton E. Darrow, Sutter Creek, Calif. (U. S. No. 1,156,276; Oct. 12, 1915.)

POTASH—Process of Recovering Potash. Arthur C. Spencer, Washington, D. C. (U. S. No. 1,157,437; Oct. 19, 1915.)

POWDERED FUEL—Engine for Utilizing Powdered Fuel. William G. Miner, Cincinnati, Ohio. (U. S. No. 1,156,702; Oct. 12, 1915.)

RADIUM—Process of Concentrating Radium Ores and Residues. Otto Paul Curt Bredt, New York, N. Y., assignor of three-fifths to Radium Therapy Corporation, New York, N. Y. (U. S. No. 1,154,231; Sept. 21, 1915.)

SEPARATION—An Improvement in the Magnetic Separation of Ores. G. B. Schwerin, Frankfurt a. Main, Germany. (Brit. No. 19,313 of 1914.)

SEPARATION—Improvements in Ore-Separating Machines. H. H. Thompson Aldridge, and A. E. Davies, Hockley Heath, Warwick, Eng. (Brit. No. 21,119 of 1914.)

SEPARATOR—Magnetic Ore Separator. August F. Jobke, Wilkinsburg, Penn., assignor of one-half to John G. Burns, Daniel Bingham, Katherine Crumay, Thomas Higgins, and H. P. Gazzam, Pittsburgh, Penn. (U. S. No. 1,157,543; Oct. 19, 1915.)

STEEL—Improvements in or Relating to the Treatment of Steel. A. Hethy, London, Eng. (Brit. No. 17,285 of 1914.)

STEEL—Manufacture of Steel. Jegor Israel Bronn, Rombach, Germany, assignor of one-half to the Firm of Rombacher Hüttenwerke, Rombach, Germany. (U. S. No. 1,156,051; Oct. 12, 1915.)

STEEL—Manufacture of Steel. William R. Walker, New York, N. Y. (U. S. No. 1,155,849; Oct. 5, 1915.)

SULPHURIC ACID—Method of Making Sulphuric Acid. Edwin Taylor, New York, and Frederick P. Bergh, Yonkers, N. Y. (U. S. No. 1,157,455; Oct. 19, 1915.)

TANKS—Lining for Tanks. Thomas E. Murray, New York, N. Y. (U. S. No. 1,156,425; Oct. 12, 1915.)

TIN—Detinning Tin Scrap. Karl Goldschmidt and Josef Weber, Essen-on-the-Ruhr, Germany, assignors, by mesne assignments, to Goldschmidt Detinning Co., Jersey City, N. J. (U. S. No. 1,158,128; Oct. 26, 1915.)

TIN—Electrolytic Refining of Tin. Robert L. Whitehead, Perth Amboy, N. J., assignor to American Smelting and Refining Co., Maurer, N. J. (U. S. No. 1,157,830; Oct. 26, 1915.)

TITANIUM—Composite Titanic-Oxide Pigment and Method of Producing Same. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,155,462; Oct. 5, 1915.)

TITANIUM—Process of Producing Titanium-Oxygen Compounds from Ilmenite or Titaniferous Iron Ores and Other Materials. Peder Farup, Trondhjem, Norway. (U. S. No. 1,156,220; Oct. 12, 1915.)

TUBE MILL. William Fennell, Southam, near Rugby, England. (U. S. Nos. 1,154,981 and 1,154,982; Sept. 28, 1915.)

TUNNELING—Method of and Apparatus for Tunnel Work. Edward G. Williams and Elmer H. Brown, Washington, D. C. (U. S. No. 1,156,830; Oct. 12, 1915.)

TUNNELING MACHINE. William E. Dean, Superior, Wis. (U. S. No. 1,156,277; Oct. 12, 1915.)

ZINC—Extraction, Purification, and Electrolytic Precipitation of Metallic Zinc from Smelter Fumes, Zinc Ores and the Like. Otto Best, San Francisco, Calif. (U. S. No. 1,151,601; Sept. 28, 1915.)

ZINC—Hydrometallurgy of Zinc. Otto Best, San Francisco, Calif. (U. S. No. 1,154,602; Sept. 28, 1915.)

ZINC—Improved Process for the Production in a Closed Cycle of Pure Carbonate of Zinc. E. Hunebelle, Paris, France. (Brit. No. 14,226 of 1914.)

ZINC—Process for the Manufacture of Spelter from Ferruginous and Admixed Zinc-Blende Ores. John James Fingland, Kaslo, B. C. (U. S. No. 1,157,375; Oct. 19, 1915.)

ZINC—Process of Smelting Zinc. Samuel Peacock, Philadelphia, Penn., assignor by mesne assignments to Agricultural Research Corporation, New York, N. Y. (U. S. No. 1,154,892; Sept. 28, 1915.)

PERSONALS

Thomas F. Cole, of Duluth, Minn., is in New York.

Walter G. Perkins, of London, is visiting New York.

Frank M. Murphy, of Prescott, Ariz., is visiting New York.

Thomas Robins is secretary of the Naval Consulting Board.

E. V. Newlands, of Toronto, Ont., has gone to British Guiana.

W. L. Saunders is second vice-chairman of the Naval Consulting Board.

Dr. L. D. Ricketts is to be the next president of the American Institute of Mining Engineers.

H. C. Hoover, who has been paying a brief visit to New York, returned to London this week.

Edmund Putnam, formerly operating at Parral, Chihuahua, Mexico, is at present in New York.

Robert Forbes, of Duluth, Minn., who is operating copper properties on Texada Island, B. C., is in New York.

F. W. Bosco has returned to Denver from a six-weeks' engagement at the Victory mine near Boise, Idaho.

Charles J. Curtin, of Brockville, Ont., is superintendent of the Kingdom lead mine at Galetta, near Arnprior.

E. Jacobs, of Victoria, B. C., is traveling through the Kootenay and Boundary districts of British Columbia.

E. B. Bronson has returned to New York from a trip to the Atlanta, Home and Calaveras properties in Nevada.

James Myers, superintendent of the Wanakah smeltery at Ouray, Colo., has resumed duties after a short illness at Golden.

Dr. T. L. Walker, of the University of Toronto, has been chosen chairman of Toronto Branch of the Canadian Mining Institute.

Robert L. Willis has been appointed steam and efficiency engineer of the Republic Steel and Iron Co., with office at Youngstown, Ohio.

Alvin R. Kenner, general superintendent of the Rio Plata Mining Co., has returned to El Paso, Texas, after spending two weeks in New York.

Mototaro Ogino, manager of the Osaka office of Furukawa & Co., of Tokyo, Japan, visited New York last week on his way from London to Japan.

Robert Marsh, Jr., of New York, has been appointed general superintendent of mines for the Nevada Consolidated Copper Co., at Ruth, Nevada.

E. J. Rogers, superintendent of the Omaha & Grant smeltery, Denver, until it was closed down, celebrated his golden wedding in Denver, Nov. 1. Shippers of ore to this once famous plant knew him well.

William D. Stevens, mining engineer and son of the late Horace J. Stevens, is reported lost in the swamp 10 miles south of Houghton, Mich. He was one of a party of seven, six of whom have found their way out.

William C. Russell, mining engineer, formerly of Denver, Colo., is now in Cardinal, Colo. He has taken the management of the Carriman Mining Co., operating the famous old Caribou property in Boulder County, Colorado.

W. R. Thurston has been appointed manager of the Mine and Smelter Supply Co.'s Salt Lake City branch. F. E. Marcy, former manager, will still be associated with the company and devote his efforts to selling and developing the Marcy ball mill.

OBITUARY

Peter Creek Fernie died recently in Victoria, B. C., aged 84 years. About 1880 he discovered outcrops of coal in the Crow's Nest Pass country, and some years later did further prospecting there, succeeding in forming a company to operate the mines. It was later absorbed by the Crow's Nest Pass Coal Co., of Toronto.

Donald E. K. Rickard, student in the College of Mining, University of California, was fatally injured in an automobile accident, dying on Oct. 23 at Berkeley, Calif. He was 21 years old, native of California, son of the late Thomas Rickard, former mayor of Berkeley, and cousin of T. A. Rickard, editor of the "Mining and Scientific Press."

Col. T. E. Vickers died recently in London, aged 82 years. He came from a family which had been in the steel trade for several generations; he was born in Sheffield and brought up to the trade. Succeeding his father in business, he gradually developed the great firm now known as Vickers, Sons & Maxim, the largest makers of war munitions in England. He was head of the company for a number of years.

Dr. James Caples died at Elk Grove, Sacramento County, Calif., Oct. 24, at the age of 92 years. He was born in Ohio and went to California across the plains in 1849. In 1879 he served as a member of the State Constitutional Convention. His first residence in California was at Hangtown (now Placerville) where he practiced medicine, ran a store and engaged in mining. His wife, to whom he was married 67 years ago, survives.

SOCIETIES

Pan-American Scientific Congress—The Second Congress will be held in Washington, Dec. 27-Jan. 8. The sessions will be held in the building of the Pan-American Union.

American Society of Mechanical Engineers—The annual meeting will be held in New York, Dec. 7-10. Headquarters will be at the Engineering Societies Building.

American Association of Engineers—The first national convention will be held at the Hotel La Salle, Chicago, Dec. 10-11. Arthur Kneisel is secretary, his address being No. 29 South La Salle St., Chicago.

INDUSTRIAL NEWS

A series of three industrial motion-picture films, illustrating the manufacture of "National" pipe, from ore to finished product, will be shown before the National Association of Stationary Engineers, No. 21, Lima, Ohio, Monday night, Nov. 15, 1915.

The exclusive manufacturing and selling rights of the Albrecht excavator and loader have been taken over by the T. L. Smith Co., 1119A 32nd St., Milwaukee, Wis. This machine is described as being halfway between the hand and steam shovel and capable of doing the work of either. Two men are required to operate it, one man in the pit to handle the scraper, and one to run the machine. A 12-hp. gas engine provides power to dig and load 20 cu.yd. per hour.

The Royal Manufacturing Co., of Rahway, N. J., extensive dealer in cotton and woolen waste, is making an attempt to standardize the trade. It has divided its wares into twelve branded grades, of which samples are furnished in a folder. The waste is bought by its branded name, and the packages are guaranteed to contain not over a certain amount of tare and to be of accurate weight, so that the payment for a lot of hoops and bagging at waste prices, or the padding of an order 30 to 50 per cent., is avoided.

Hamilton & Hansell, Whitehall Bldg., New York, report the recent sale of a 4-ton Rennerfelt electric-arc furnace to the Old Dominion Iron and Nail Works Co., Richmond, Va. This furnace will be used to make steel for rolling 2-in. billets. Of other Rennerfelt electric-arc furnaces—34 have been sold—15 are used for making steel for castings, 5 for tool steel, 4 for brass melting, 2 each for chemical purposes and iron castings, and 1 each for nickel, copper and ferromanganese melting. Some of these furnaces, however, are used for more than the one purpose listed.

More than 20 nations are represented by visitors to the United States who are now making their headquarters at the branch offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, and who are seeking new trade relations. Many of these men are members of foreign firms which are preparing to make purchases here. Others are representatives of big commercial houses and offer unusual facilities for our manufacturers to establish agencies abroad. Their earnest efforts to meet us half-way in producing a greater volume of trade with their respective countries are making easier the progress of American commerce in this year of opportunity. Because of the foreign visitors flocking here, the Bureau is dealing directly with buyers as well as sellers, and bringing both classes of business men together so effectively that there are results—purchases of American goods and the making of contracts for agencies in other countries.

Editorial Correspondence

SAN FRANCISCO—Nov. 3

California Metal Producers Association held its first annual meeting at San Francisco, Oct. 27. Reports from President Albert Burch and Secretary-Treasurer Robert I. Kerr showed that the membership has increased from 22 to 41 and now represents approximately 90% of the aggregate capital invested and 90% of the employment of labor in the metal mines of California. The association has taken an active interest in mining affairs for the betterment of the interests of investors and producers and incidentally to the advantage of employees. The accomplishments of the past year include the reduction of workmen's compensation insurance, which resulted in a saving of many thousands of dollars to all mine operators, and the prevention of legislation detrimental to mine operations. The association also took up the question of mine safety in joint meetings with the State Industrial Accident Commission, with the result that the rules finally adopted by the commission and which become operative under the compensation and insurance act are far more favorable to the satisfactory operation of the mines than would have resulted in the absence of concerted action on the part of owners and operators of metal mines. The association financed the field meets at the Panama-Pacific Exposition in September, and will work for the proposed revision of the national mining laws. The executive board consists of Albert Burch, president; George W. Metcalfe, first vice-president; E. C. Hutchinson, second vice-president and C. E. Knox, George W. Starr, Newton Cleaveland, S. W. Mudd. Finance committee: Louis Rosenfeld, Henry Malloch, William Hauge. Secretary-treasurer Robert I. Kerr, who in the last half of the year succeeded John Mocine, resigned. The association has permanent quarters at 631 Market St., San Francisco.

Ore Transportation from the Ubehebe District, in the northeastern part of Inyo County, will be undertaken with Yuba ball-tread tractors manufactured by Yuba Construction Co., at Marysville. The district lies on the edge of the county, 60 mi. east of Laws, a shipping station on the Southern Pacific and 51 mi. northwest of Bonnie Clare, Nev., a shipping station on the Tonopah & Tidewater R.R. The trial trips of the tractors hauling the ore wagons will be made to the Tonopah & Tidewater. Yuba Construction Co. has placed one of its tractors at the disposal of the mine operators and four ore wagons have been provided for the experiment. F. A. Campbell has undertaken the contract to haul the ore to be furnished by W. W. Waterson, Archie Farrington and others, who agree to furnish 500 tons for a beginning. The road has been examined and is rated fair, with no apparent obstruction to economic operation of the tractor. The Ubehebe district contains many and large veins of copper, lead and silver ores which may be developed and operated only with the aid of economic transportation to shipping points. The district is in the same commercial situation that many other mining districts and camps in California and Nevada occupy, and which must remain undeveloped if they depend upon animal transportation of ores. Motor trucks have been used economically in many districts or camps where the transportation requirements are not large. But in cases of large amounts of ore to be shipped daily, the motor truck is not an economic transport, as a separate truck is required for each load and the labor cost is increased by the necessity of employing a driver for each truck. Another disadvantage of the motor truck is, that unusual grades or pieces of bad road require unloading of part of the ore and making two trips with a load that can be carried on ordinary grades and good roads. The same condition of heavy grades and bad roads must inevitably be met by the tractors; but the necessity of unloading and reloading is avoided by the fact that the tractor hauls the loaded wagons, which may be taken over one at a time, but carries no load on its own wheels except its engine and essential machinery and driver. The Yuba tractors are of the caterpillar type, but are light and capable of being turned in narrow roads at sharper angles than the usual type of motor truck, which must of necessity carry its load above its driving machinery and running gear, making it top heavy and unsafe on narrow roads and difficult grades. However, there are conditions in the mining districts of California and Nevada which are ideal for the motor truck method of transportation, which render the caterpillar type of transport unsatisfactory for economic ore hauling. Both methods are available under conditions suited to their respective advantages and both are gradually displacing the animal hauling and making possible the economic transportation of ores from any district where horses or mules can travel with wagons.

DENVER—Nov. 4

Colorado Fuel and Iron Co. is investigating two deposits of iron ore in Wyoming—the Popo Agie tract, 12 miles from Lander, and the Welsh tract, 19 miles from the same railroad point. Should these deposits prove of proper grade and size, company may erect a blast furnace at some central point for treating the ore from these properties as well as from the mines at Sunrise, Guernsey and Hartville.

Radium-Bearing Lands in Colorado are again in the limelight. Thomas R. Henahan, formerly Colorado's commissioner of mines and now retained by the Standard Chemical Co., after a thorough personal investigation of the radium-bearing lands in western Colorado and eastern Utah, has written an open letter to Secretary of the Interior Franklin K. Lane, strenuously opposing the proposed withdrawal of such mineral lands from public entry and making caustic criticism of statements made by Bureau of Mines experts. He contradicts the statement that these fields will supply radium for a few years only and expresses the belief that none of the experts has been 10 miles away from an automobile road while making his investigations.

BUTTE—Nov. 4

Suits Resulting from Butte's Street Riots of last year are now being heard. On Nov. 1, Judge Lynch sustained the demurrer entered by the City of Butte to the complaint of the Butte Miners' Union, which has filed a suit against the city for $140,000 damages to Union property during last year's rioting. The demurrer set up that the complaint was not sufficiently definite to constitute cause of action. Attorney for old union was allowed 20 days in which to file amended complaint. Arguing in support of sufficiency of the complaint Attorney Breen for the union alleged that mob which blew up the union hall was not restrained by policemen who had been held in reserve and that therefore liability for destruction of property fell on city which did not use its police powers. The suit brought by Charles H. Moyer and trustees of Western Federation of Miners against the Butte Miners' Union will be heard in the Federal court, according to decision handed down Oct. 28 by Judge Bourquin. Court denied motion to dismiss action. Suit was brought to get possession of property of Butte Miners' Union.

SALT LAKE CITY—Nov. 5

In the Tintic District, several new roads have been built, or are to be built. The Chief Consolidated has completed its road from the Scotia mine in West Tintic to Jericho on the Salt Lake route, and ore hauling by traction engine and trailers will begin shortly. A new wagon road is to be built between Tintic Junction and Eureka; also one south from Silver City to connect with the Millard County road near Lynn Junction.

The Strike at the Silver King Coalition in Park City is still undecided. The miners have been addressed by Thomas Kearns, general manager, who stated the company's position. About 200 men met in Park City and voted to stay out indefinitely, or until some change is shown by the management in regard to the hospital question. A few men returned to work Nov. 4, and are employed about the mill in the installation of the flotation plant. Others who have been in favor of returning to work, were kept from doing so by fear. There are 34 deputy sheriffs at the mine under Sheriff Ryan, although no violence is expected. It is thought that both sides will refuse to yield and that ultimately the company will bring in outside men.

SEATTLE—Nov. 3

A Deposit of Chromic Iron has been found in Alaska at the head of a small bay on the peninsula between Seldovia and Dick's Bay. It is about eight miles from tidewater and a valley provides easy means of transportation for ores to the beach. The deposit has been known to miners for the last year but the extent of the orebodies was not determined until recently. It is now reported to be over one mile wide and

several miles long. The contact is very marked. Vegetation grows luxuriantly up to the change in formation where the surface then assumes a dull yellow. The peculiar color of the mountain is due to the leaching. Below the surface the ore is black. A little development work has been done on some of the Elizabeth group of islands lying off the main body in the bay. The discovery is hailed by mining operators in the north as one of the most important made in recent years as chromite is in great demand.

Wood in the Fairbanks Mining District is getting to be classed as jewelry. Twenty dollars a cord is the highest price so far, but it is still going up. In the Nenana coal field, about 100 mi. from Fairbanks, are vast beds of lignite coal, which will be available as soon as some method of transportation is provided. It is expected that a railroad to these coal fields from Fairbanks, even before the trunk line is completed, will greatly increase quartz mining activity in that district. With coal available for fuel, large areas of low-grade auriferous gravel, which cannot be worked with fuel ranging from $10 to $20 a cord, will become productive, and the placer gold output will be largely increased, if not doubled. Quartz mining and milling is an established industry in which only high-grade ores can be worked with a profit, owing to the high fuel charges. Congress, which is about to meet, will be asked to appropriate money to enable the Alaska Engineering Commission to carry on its work of constructing a railroad from Seward to Fairbanks. The Fairbanks people are behind a get-together movement to push this thing, in order to get coal into the Fairbanks district.

WALLACE, IDA.—Nov. 4

The Bunker Hill & Sullivan company has made no definite announcement regarding the situation the smelter it is preparing to build, but indications clearly point to Kellogg as the place. Easements which will secure the company against possible damages from smoke have been secured in most of the land that would possibly be affected, and Mr. LaBarthe, of the engineering firm which will design the plant, has been on the ground for several weeks working out the preliminary details. The talk of trouble with the American Smelting and Refining Co., which has a contract with the Bunker Hill & Sullivan company covering a period of 15 years, was silenced a few days ago when Stanly A. Easton, manager of the Bunker Hill & Sullivan company, stated that the A. S. & R. company could no more stop the Bunker Hill from smelting its own ore than it could prevent it from concentrating it. Mr. Easton also stated that the proposed plant would be in position to handle the ores of other lead mines, an announcement that has been received with much satisfaction here, as a local plant will certainly be highly beneficial to the mining industry. It was rumored during the week that representatives of other large smelter interests which are supposed to have an unwritten agreement with the A. S. & R., have been in the district recently prepared to offer concessions to the Bunker Hill in the hope of getting the company to abandon the smelter plan, but there is no evidence that these efforts if made have met with encouragement.

In Securing Control of the Ray-Jefferson the Day family is about to embark in zinc mining in addition to its extensive operations in lead. The Ray-Jefferson owns 32 claims, with mill site and water rights, on Beaver Creek, and extensive development has disclosed large bodies of zinc and considerable lead. The property joins the Interstate-Callahan on the west and is supposed to have the extension of zinc oreshoot from which property has paid nearly $2,000,000 in dividends during the past year. A few weeks ago when the announcement was made that the Ray-Jefferson had been financed to the extent of $200,000 which would insure its further development and the erection of a 250-ton mill in the spring, it was known that the financial support had come from the Days, who were already quite heavy stockholders in the company. A meeting of the directors of the Ray-Jefferson recently submitted a proposition to the stockholders to increase the capital stock of the company from 1,500,000 shares to 2,000,000, and the stockholders will meet on Nov. 6 in this city to take action. There is no doubt that the proposition will carry, and it is understood that the additional stock will go to the Days in return for the cash they have agreed to advance. This with their present holdings and other stock that is friendly to them will make them the controlling factor. In this connection the attitude of the Interstate-Callahan company is of more than passing interest. Several months ago this company made overtures for the purchase of the Ray-Jefferson, but without success. These were renewed recently and are now being pressed, the figure being offered individual stockholders being on a basis of near $1,000,000 for the property. The anxiety of the Interstate-Callahan people to secure the Ray-Jefferson is not due wholly to the probability that its orebodies extend into the Ray-Jefferson ground. Another reason of even greater importance is believed to have been disclosed in the action of the Callahan-Boutin faction of the Interstate-Callahan about a month ago in applying to the district court here for the appointment of a receiver to take charge of the company's property, and the appointment of Eugene R. Day, manager of the Hercules mine, receiver. This action was blocked by the Percival-Robbers faction, which is in control of the property, which succeeded in having the application for a receiver transferred to the federal court, where it is now pending. It now appears that the Interstate-Callahan company, as represented by the Percival-Robbers element, has discovered in this action to throw the property into the hands of a receiver, and particiularly in the appointment of Mr. Day, the first step in a scheme to dissolve or unconsolidate the Consolidated Interstate-Callahan Mining Co. with the ultimate purpose in view of consolidating the Callahan with the Ray-Jefferson and leaving the Interstate to hold the bag, so to speak, as it is known that the big end of the orebodies of the consolidated property is in the Callahan ground. With the Days in control of the Ray-Jefferson and the possibility of the Interstate-Callahan company being thrown into the hands of a receiver, the men who exercise control of the big zinc producer are evidently acting upon the belief that the acquisition of the Ray-Jefferson is as necessary for the security of their present holdings as it is for its additional ore reserves.

MORENCI, ARIZ.—Nov. 5

The Western Federation has tightened the censorship in the Clifton-Morenci-Metcalf strike district. One's comings and goings are investigated closely, and woe unto him whose passport is found wanting. It is said nobody can leave camp with a ticket that reads to Duncan, where the companies have established a tent colony to accommodate such apostates as have seen the error of their way and wish to return to the good graces of the company that has given them an opportunity to earn a goodly livelihood these 20 years. All persons arriving in the district are closely interrogated as to their business, length of sojourn, etc. About 2,000 men met the train at Clifton Nov. 1, and made a public bonfire of copies of the El Paso "Morning Times," which paper is barred from the district. Governor Hunt has headed a public subscription with $500 and asks all citizens to follow suit with a donation for strikers, and the federation has assessed every member in the state from $1 to $2 a month, according to his wage. Cyclone Davis, Congressman from Texas, offers his oratorical assistance to Hunt in fighting the recall petition.

TORONTO—Nov. 6

An Engineer of the Provincial Hydro-Electric Commission, at the request of a number of the mine managers in Cobalt and Porcupine, is making a survey of the power conditions in these two camps and in Sudbury. It is the belief of a number of those interested in mining in northern Ontario that the cost of electric power is much higher than is warranted by conditions. The conditions at Sudbury will not enter very largely into the matter as the plants there are owned largely by the operating companies, but it will give them a basis for comparison of costs with Cobalt and Porcupine. While it is very unlikely that the Hydro-Commission will build in northern Ontario, it may be able to help the mines to obtain lower rates.

VICTORIA, B. C.—Nov. 1

A Rich Strike of Placer Gold has been made on Rude Creek, a tributary of the Klotosson River, and a stampede is now on for that district, according to Commissioner George Black, head of the government in the Yukon Territory who, on his way out, met as many as 150 men on their way in to the new field. The discovery of placer gold was made in September by Jens Rude and his partner, two prospectors. The creek has been named Rude Creek. The sand and gravel of the creek has yielded $1.50 per sq.ft. to a depth of 6 ft. The prospectors brought out 50 oz. in gold at the time they staked their claims. It has been the policy of the Yukon Government to assist the prospectors by furnishing them with free transportation when they have a grubstake sufficient to last them a year. Jens Rude and his partner were two of these prospectors who were thus assisted. They went over the waters of the Yukon, up the White River to the Klotosson River. The government is gratified to see that their efforts in assisting the prospector have met with such success. The point where the gold was discovered is 30 mi. from navigation on the Yukon. The government is cutting a trail in for the accommodation of the miners. Little work can be done this year owing to the lateness of the season when the discovery was made. The men are going in, however, to stake their claims and get ready for operations in the spring. The discoverers are allowed to stake 1,500 ft. along the stream and 1,000 ft. on each side. Those who come after are allowed to stake 500 ft. along the stream, by 2,000 ft. in width.

The Mining News

ALASKA

OUTPUT FOR THE CHISANA DISTRICT is estimated for the year at about $150,000. The mining season has closed there. Some good prospects were found just before the ground froze on Beaver Creek.

GRANITE (Port Wells)—Ore struck at 350-ft. level, through raise from lower adit.

ALASKA MEXICAN (Treadwell)—In September, mill crushed 18,690 tons, yielding $1.42 per ton; net profit, $2,342.

ALASKA TREADWELL (Treadwell)—In September, mills crushed 80,472 tons, yielding $148,842, or $1.87 per ton; operating profit, $60,590; net profit, $52,660.

ALASKA UNITED (Treadwell)—In September, Ready Bullion and 700-Ft. Claim mills crushed 20,104 and 22,890 tons respectively, yielding $1.91 and $1.35 per ton; net profits, $3,022 and $933.

FILDAGO-ALASKA COPPER (Valdez)—Supt. E. D. Reiter states that development will continue throughout the winter and more equipment will be installed next spring. Ore encountered in main raise.

WELSH (Knights Island)—H. C. Vance, who is developing a copper mine at Bay of Isles on Knights Island for Martin Welsh, of Spokane, reports that shaft has encountered ore carrying 10% copper. Plans for wharf for deep-water ships are ready and an adit will be started this winter.

ALASKA MINES EXPLORATION (Seward)—J. H. Sears, Jas. McCoy and Roy D. Fonda have filed articles of incorporation for above company at Juneau. Sears is president of Seward branch of Harriman Bank, and connected with that banking concern at its New York address. Purpose of new company to examine, develop and operate mines in Alaska.

GUGGENHEIM DREDGE (Ruby)—About 400 tons of machinery are being shipped by Guggenheim interests from Dawson to Ruby, where the new dredge will be assembled on ground recently acquired. Active operations on one of the largest dredging propositions ever started in the North will be undertaken next spring.

CLIFF LITIGATION (Valdez)—In the suit brought by Edmund Smith, George Treat and L. Archibald against H. E. Ellis for their claimed interest in the famous Cliff property, the decision in the district court gave Treat a one-tenth interest and the remaining claimants divide a tenth interest. Ellis is working the property and it promises to become a producer again.

ARIZONA

Greenlee County

ARIZONA COPPER (Clifton)—The concentrator at Clifton was burned on the night of Nov. 5. This is the No. 4 mill which was recently remodeled and enlarged to treat 500 tons daily.

Mohave County

UNITED EASTERN (Oatman)—Managing director George Long quoted as stating machinery ordered for 200-ton mill. Also installing extensive mining equipment.

CALIFORNIA

Amador County

LUDEKENS (Pine Grove)—Application made to California Débris Commission to operate by hydraulic process and impound tailings in Grass Valley Creek, draining into Mokelumne River, to be heard at San Francisco, Nov. 15.

ORIGINAL AMADOR (Amador City)—Shaft will be deepened and new levels run for development of orebody below present workings. Extraction of ore will be reduced, but 10 stamps will be kept dropping while sinking is in progress. T. S. O'Brien is manager.

Calaveras County

ASBESTOS DEPOSITS near Copperopolis reported to be in preparation for development and operation. Product will be used for manufacture of fireproof plaster. Fiber is not equal to demand for usual commercial asbestos. Ten men are now employed and number will be increased as work requires.

Eldorado County

DREDGING GROUND on south fork American River near Coloma is being prospected with No. 3 Keystone drill by J. H. Mulloch of San Francisco, who has bonded ground. This is neighborhood in which gold was discovered by Marshall causing first gold rush to California. Reported that W. R. Bell is also interested in bonding other ground in this vicinity, and that installation of California type dredges is probable.

GRIZZLY FLATS (Grizzly Flats)—Property embracing about 140 acres taken over by Los Angeles men. Tunnel is being repaired and timbers cut in preparation for extensive development. Installation of 10-stamp mill contemplated. Deposit contains cemented gravel.

Inyo County

BUNKER HILL (White Mountain District)—S. T. Paul and Tex Hall are investigating property with probable view of taking purchase option.

LUCKY JIM (Darwin)—Darwin Development Co. has option of purchase and is making examination under superintendency of S. T. Paul. Reported that 25-ton flotation plant and other essential concentration machinery will be installed if development warrants taking over property.

Madera County

ELECTRIC POWER for mines in Grub Gulch district will be provided by extensions made by San Joaquin Power Co. Enterprise and Gambetta mines are preparing for electrical installations. Lack of economic power has been largely responsible for slow development and operation of mines in Madera County since necessity for economic methods of treating low-grade ores is imperative.

Nevada County

GOLDEN CENTER (Grass Valley)—High-grade ore has been disclosed; 10 stamps are dropping on good ore and an increase of capacity of mill is contemplated.

COLUMBIA CONSOLIDATED (Washington)—Mine being placed in shape for production. Mill formerly operated at German mine has been purchased and will be put in commission immediately. Aërial tram from mine to mill is completed and underground work is progressing. Orebodies are large; ore is chiefly free-milling.

DINERO MINING CO. (Washington)—Incorporated with capitalization of $2,000,000 by A. T. Hathaway, W. J. Conners, S. Montague and others. Company will purchase Yuba group of 16 quartz claims at Maybert. Unwatering 960-ft. shaft will begin as soon as repairs are made; shaft will then be deepened to 1,000 ft. and drifting will follow. Mine is equipped with good pumping and hoisting plants and two mills of combined capacity of 30 stamps. Present plans contemplate year of development before milling of ore is undertaken.

Plumas County

GRANITE BASIN district development has brought about reëstablishment of old stage line from Oroville, which had been abandoned for several years. Distance is 50 mi., though Western Pacific Ry. passes within about 10 mi. to west of district. Quincy is nearest important town in Plumas County, situated about 40 mi. northeast.

Sierra County

RATTLESNAKE (Downieville)—Gravel yielding $4 per carload in gold is being worked by Deal & Dills, and breasting will continue during winter.

SPHOON AND LOUISE (Alleghany)—Durston Gold Mining Co. has 20 men grading for buildings, and developing quartz veins on both claims. C. O. Jackson, manager.

MINER'S HOME (Howland Flat)—Under bond to J. Nash. Much gravel worked during summer, with good results. Snowshed built, and work will be continued throughout winter.

ORIENTAL (Alleghany)—Rich ore being extracted at 600-ft. level. Grading for quartz mill under way. Under management of W. B. Pearson, for Croesus Gold Mining Co. of New York.

MOUNT ALTA (Sleighville House)—Gravel paying well. Main tunnel 300 ft. ahead of breasts, and with plentiful supply of water for washing; present crew of 10 will be doubled. Sutro and Chatfield of San Francisco are operating.

WILLOUGHBY (Sierra City)—New payshoot struck, yielding $50 per ton free gold in stamp mill, with rich sulphide tailings yet to be treated. An electric plant, air compressor and power drills will be installed later. Owners are Dr. R. L. Jump, of Fruitvale, and E. M. Farrell, of Downieville.

COLORADO

Lake County

DOWN TOWN MINES CO. (Leadville)—Contract let to the Providence Engineering Works for a station pump to be installed on the bottom level when unwatering is complete. This centrifugal pump will have a capacity of 2,000 gal. per min. against a head of 900 ft. and will be direct connected to a 650-hp. General Electric motor running at 1,800 r.p.m. Pumping proceeds with the sinking equipment. No attempt has been or will be made to reopen any of the old workings thus far drained until the unwatering project is finished. Weirs have been provided in the run-off ditch from the Penrose shaft and accurate flow measurements are made regularly.

Summit County

TONOPAH PLACER CO. (Breckenridge)—For quarter ended Aug. 31, net earnings were $114,000.

Teller County

CRIPPLE CREEK PRODUCTION FOR OCTOBER is estimated at 92,000 tons of ore averaging $13.80 per ton. Of this, fully 31,000 tons was waste and dump material averaging $2.69 per ton. The big Golden Cycle mill at Colorado City roasted and cyanided 1,400 tons per day—nearly one ton per minute—a record.

IDAHO

Shoshone County

GOLDEN WINNIE (Murray)—Bennett Bates, who has option on this old gold-tungsten property, is getting out tungsten ore for test run.

HAMBURG-AMERICAN (Little North Fork)—Crosscut at this property has been driven in lode 26 ft. without reaching wall. Assays of 4 to 6% copper are reported.

TERRIBLE EDITH (Little North Fork)—Charles Conn, lessee, received $5,200 from two cars of zinc ore shipped during September. Payment of $80,000 on option falls due Dec. 1.

HYPOTHEEK (Kellogg)—J. O. Tucker, who owns ranch below this mine, has filed suit against company involving water right. Asks damages of $5,000 for diverting water belonging to him and $5,000 for destroying agricultural value of land.

H. E. M. (Wallace)—New 100-ton capacity mill, situated about mile west of Wallace, made its trial run this week with satisfactory results. It is plan of company to connect mine and mill by ½-mi. electric tram, but for present ore will be delivered at mill by wagon.

SUCCESS (Wallace)—At meeting of directors at Wallace Oct. 30, it was stated that orebodies already developed were sufficient to run mill at capacity for about a year. New pump on 1,200 level will be in operation soon, and sinking to 1,400 will commence.

SILVER CABLE (Mullan)—Carload of 30% zinc ore shipped from this property few weeks ago did not yield satisfactory returns. Large body of zinc and some lead has been proven in intermediate tunnel which has recently been connected with lower tunnel by raise of 200 ft. Will continue development during winter with expectation of erecting mill in spring.

SNOWSTORM (Mullan)—No official announcement made but it is understood that Snowstorm has taken over Banner & Bangle mine near Troy, Mont. When Snowstorm was abandoned about year ago, company had $170,000 in treasury and management announced that this would be used to acquire other mining property; understood Troy property has been secured in pursuance of this purpose. Banner & Bangle has been under development for some years by Leo Greenough, manager of Snowstorm. It is silver-lead property.

ROANOKE (Kellogg)—Roanoke company this week gave lease on its property to John Grenfell, of Kellogg, for term of three years; company to receive royalty of 15% on net returns from all ore shipped; lessee agrees to keep at least two men working not less than 30 shifts per man per month. Property is on Elk Creek and is developed by tunnel 400 ft. on vein and shaft 300 ft. deep, from bottom of which vein is explored 100 ft. In both tunnel and shaft there is from 10 to 18 in. of lead ore, high in silver. Hoist is operated by electric power. Mine is 1½ mi. from railroad and is reached by good wagon road.

GEORGIA

FINDLEY RIDGE CO. (Dahlonega)—The Crown Mountain 50-stamp mill has been destroyed by fire. Owners had just completed a ½-mile mule tramway from the openpit mine to this mill and expected to add cyaniding equipment to treat tailings from the amalgamation department. A. H. Head, superintendent.

MICHIGAN

Copper

MICHIGAN (Houghton)—Operations continue at this property with 30 men employed. They are working in a field that has not been operated since the Civil War. Exploration work done to date has given fair indications.

MASS CONSOLIDATED (Rockland)—This property now working to mill capacity and handling highest grade tonnage that ever has been taken from the property, including an unusual amount of "mass and barrel stuff" that goes straight to smelting works.

LAKE (Houghton)—The one thing that is holding back work is the inability to secure drilling machines, the market for which is overtaxed. Calumet & Hecla is just getting the last consignment of one order for 500 machines. Mass expects to have more drills within two weeks, when more rock can be shipped to the mill.

Iron

FLORENCE (Florence)—Orders were given this week by Felix A. Vogel, of New York, to reopen the mine. It has been idle a long time.

BALTIC (Iron River)—About 50 men are employed opening mine. By middle of November about 150 will be at work. Mining will be pushed all winter.

LAKE ANGELINE (Ishpeming)—Cleveland-Cliffs Iron Co., the new owners, started two diamond drills Nov. 6. Some test-pitting also being carried on.

FOGARTY (Iron River)—Shovel was started here this week. It is expected that mine will be opened again before long. All of other Pickands-Mather properties on range are operating actively.

CORRIGAN, McKINNEY & CO. (Crystal Falls)—All of ore in stock has been shipped from Kimball, Tobin & Dunn. Only Great Western pile remains. Company has refused to dispose of any more ore at current prices.

MORRIS (Ishpeming)—A motor-size drift was extended 422 ft. during October, breaking the Cleveland-Cliff Iron Co.'s record for rock drifting. Two machines were used and there were four muckers. The rock is hard to drill and break.

HANOUSEK (Wakefield)—Coates & Tweed are preparing to open this property situated short distance from new Wakefield mine of M. A. Hanna Co. Large orebody has been developed. Ore will be taken out with steam shovels. Northwestern road will run spur track from Mikado mine.

PENN IRON CO. (Vulcan)—The Bucyrus company is endeavoring to purchase the patents of the hydro-electric shovel invented by F. Armstrong of Penn company. It is likely that deal will be closed. One of shovels has been doing satisfactory work at Vulcan.

MINNESOTA

Cuyuna Range

HOPKINS (Ironton)—Cuyuna-Sultana Iron Company's shaft is now known as the Hopkins. Production continues at 150 tons daily. Concentrator will operate all winter.

Duluth

MINNESOTA STEEL (Duluth)—Cargo of 1,500 tons of ferromanganese was received this week from Conneaut, Ohio. It was mined in Cuba. Value of cargo was placed at $165,000. More shipments are expected to arrive in near future. Steel making to be started Nov. 10.

MINNESOTA IRON DEVELOPMENT CO. (Duluth)—Company recently organized to take over nearly 9,000 acres of undeveloped fee lands on Cuyuna, Mesabi and Vermilion ranges. E. J. W. Donahue and John Wahl, of Duluth, prominent Cuyuna Range promoters, are directors.

Mesabi Range

RUDDY (Biwabik)—Mine closed down temporarily to permit repairs to shaft.

ORDEAN (Virginia)—Stripping operations begun on this property Oct. 26. Controlled by Oliver Iron Mining Co.

HULL-RUST (Hibbing)—Is the leading 1915 shipper, with daily shipments of 700 carloads.

GREAT NORTHERN ORE—While not authoritatively announced, it is said that the newly organized Midvale Steel and Ordnance Co. has agreement or understanding whereby it controls 300,000,000 tons of iron ore owned by the Great Northern. This gives Midvale about one-third the ore reserve that the Steel Corporation has.

MACE (Nashwauk)—Big steam shovel being used by Butler Bros. in stripping here is attracting considerable attention from mining men. Results are entirely satisfactory. Boom is 90 ft. in length. First dippers used had capacity of 6 cu.yd. They wore out rapidly. Dippers holding 4 cu.yd. are giving better results.

Vermilion Range

SIBLEY (Ely)—Shaft sinking completed and erection of shaft house started. Old Sibley shaft, in which six men were buried about year ago, will be abandoned as soon as new shaft is ready.

MISSOURI—KANSAS—OKLAHOMA

DAY-COOTER MINING CO. (Commerce, Okla.)—Mill will be ready for operation soon. It is east of the Cornfield property.

BEAVER (Commerce, Okla.)—Plant completed on lease north of Commerce; ground thoroughly prospected and reported to be rich.

GARTUNG & CO. (Commerce, Okla.)—Has replaced Ripley tables by Wilfleys. Mill is only tailing mill in district where there are no cleaner jigs, ore being sent from roughers to series of tables.

BLUE GOOSE (Cardin, Okla.)—This new mill of Commerce Mining and Royalty has started producing ore. Beaver mill belonging to same company is rapidly nearing completion and will be running in next couple of weeks.

MURPHY LAND (Galena, Kan.)—Mines leased and operated by James Clifford and George Roland lost machinery and ore by cave-in and flood resulting from broken flume. A new shaft will be sunk in solid ground. The two new pumps installed by James Murphy, owner of the Murphy Land, have about drained the ground and miners are returning to work.

EMPIRE MINE (Galena, Kan.)—Large compressor being installed to furnish power for drills, and large derrick is being erected at new shaft sunk recently into ore. A 900-ft. tramway will be built from shaft to mill. Empire is one of largest producers in district, 5½ tons of ore being made per shift; expect to make 10 or 12 per shift as soon as repairs are made and both shafts are in operation.

CHARLES TURNER (Joplin, Mo.)—Expects within next few weeks to commence building of new mill on his lease on Riseling land southwest of Joplin; already has 3,000 tons of dirt ready to hoist and mill. Has three shafts in ore ready to work down to 150-ft. level. Ore was struck at 60-ft. level in paying quantity, but best ore is from 110 ft. to 150 ft. Land was formerly operated by Live Oak Mining Co. of Joplin, Mo., but its mill burned about 7 years ago, and prices of ore did not justify rebuilding at that time, hence ground has been idle since then.

MONTANA

Lewis and Clark County

HELENA MINING BUREAU (Helena)—Members of bureau, incorporated some time ago to try out possibilities of promising mines and prospects in districts tributary to Helena, recently made inspection trip over new property taken over at head of Nelson Creek. Development on four gold claims consists of shaft, drifts and open cuts on surface along outcrop of vein which is 20 ft. wide. Work will be started at once. Mining activity, stimulated by work on old Witlatch mine, where leasers have been steadily mining and milling at a profit.

Silver Bow County

BUTTE & BACORN (Butte)—In decree signed Oct. 28 by Judge Lynch, sale of property is ordered to satisfy claims of note holders.

BUTTE & LONDON (Butte)—Work of unwatering shaft completed Oct. 30; sinking begun Nov. 2 and will be kept up at the rate of about 100 ft. per month. Company expects to begin crosscutting early next spring. It is planned to keep three shifts of five men each at work.

BUTTE-ALEX SCOTT (Butte)—Since resuming operations, Oct. 9, 200 tons of ore per day has been shipped, 25% of which was first-class ore. All ore now taken from 2,000-ft. level. As soon as development work on 2,200-ft. level will permit hoisting ore, output will be increased to 400 tons of ore per day. Ore being smelted by East Butte company.

BUTTE & SUPERIOR (Butte)—Company broke all previous records during October, when more than 47,000 tons of ore were mined at Black Rock mine and over 14,000 tons of concentrates produced in mill. From this ore were recovered 15,500,000 lb. of zinc, equivalent to an extraction of 95%. Company's payrolls for month will exceed $180,000, based on $4-per day scale, price of copper having been above 17c. during October. Preparations are going forward for development work at Butte-New York property, which is controlled by Butte & Superior. Crosscut to Colonel Sellers vein has been run on 1,200-ft. level of Black Rock. Vein is from 7 to 8 ft. wide with 1 ft. of 17% zinc in center. Another crosscut will soon be run to Pollock vein.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Production for October was 36,500 tons of ore. Gross yield, $256,000. Net realization, $101,000. September costs were $4.44 per ton and 2,204 ft. of development was done at $4.60 per ft.

Humboldt County

ST. ANTHONY (Toy)—Situated 21 mi., southwest of Lovelock but close to Southern Pacific tracks has practically completed 50-ton tungsten concentrating plant.

Mineral County

PAMLICO PLACER (Hawthorne)—This company has closed down, operations not having been so profitable as samples indicated.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 30 amounted to 9,891 tons valued at $203,998 compared with 9,704 tons week previous. Producers were Tonopah Belmont, 2,899 tons; Tonopah Mining, 3,050; Tonopah Extension, 1,850; West End, 881; Jim Butler, 1,100; Halifax, 54; and miscellaneous leasers, 57 tons.

TONOPAH MINING (Tonopah)—For quarter ended Aug. 31, gross value of ore milled was $511,724; net realization of $166,388. Metal losses in milling and refining were $39,699.

CASH BOY (Tonopah)—Bins being erected to facilitate shipping. North drift on 1,450-ft. level shows 3 ft. of ore accompanied by 3 ft. of low-grade material. Air connections will be made with the Victor. Expect to conclude side-line agreement with Tonopah Extension.

HALIFAX-TONOPAH MINING CO. (Tonopah)—Encountered ore at a depth of 1,200 ft. and about midway between the end and side lines of their group of four claims. Drifts on vein being started, winze now down 25 ft. in ore and 54 tons shipped to West End mill are expected to yield between $35 and $50 per ton.

Storey County

ANDES (Virginia)—Cleaning out 175 level and working in old stope above level. Saved 39 cars of ore and fill.

SIERRA NEVADA (Virginia)—At 45 ft. point in west crosscut 2,500 level face in ore averaging $85 per ton. Saved 49 cars of ore averaging $32.34 per ton.

OPHIR (Virginia)—Sinking winze on vein below 2,500 level continued in low grade ore. Central tunnel extracted 355 cars of ore and milled 240 tons. North drift 250 level advanced two sets in milling ore. Jointly with Con. Virginia extended west crosscut on 2,700 level to open vein.

UNION CON. (Virginia)—Six feet of $50-ore exposed at south end of No. 3 stope 2,500 level. In No. 1 raise, best ore shifted to foot wall; ore assaying $21 per ton. Union No. 1 raise north drift face in ore averaging $19 per ton. Saved 142 cars of ore assaying $9.47 per ton and 91 cars averaging $19.73 per ton.

CROWN POINT-BELCHER (Gold Hill)—Water lowered to 70 ft. point below 1,600 level. Recovered No. 1 pump to be overhauled and put in commission 1,400 station. Milling ore saved from 1,300 and 1,400 levels and 779 tons of dump rock and 198 tons of mine rock received at Jacket mill. Bullion shipped.

SOUTH DAKOTA

Lawrence County

HOMESTAKE (Lead)—A crew of men has been put to work taking out tungsten ore from the Harrison claim and a shipment of wolframite is about ready for the market. The material occurs in the flat formation, lying above the quartzite

WASP NO. 2 (Flatiron)—Directors decided to erect a concentrator to handle low-grade tungsten ore. Capacity of plant will be about 25 tons daily. Regular shipments of high-grade tungsten ore are being made. Gold mill is operating on reduced capacity.

UTAH

Beaver County

MOSCOW (Milford)—First car of ore from new zinc strike on 200 level has been shipped.

HORN SILVER (Frisco)—Annual meeting was held Oct. 20, and report will be issued soon after first of coming year. Present directors were reelected.

UTAH LEASING (Newhouse)—Company's new mill, which is to work Cactus dump, is practically completed. Tailings carry about 14 lb. copper per ton.

MAJESTIC (Milford)—Shipments during October amounted to 20 cars of ore from large open cut at Hickory mine. Shaft at Hoosier Boy is being sunk to 600 level, where station will be cut and drifting for vein started. It is planned ultimately to sink shaft to 1,000 level.

Juab County

TINTIC ORE PRODUCTION for week ended Oct. 30 amounted to 132 carloads, estimated at 6,600 tons, valued at $165,000, compared with 121 carloads week previous.

Piute County

MINERAL PRODUCTS (Marysvale)—Initial carload of potash was shipped Oct. 22 by this company, and marks first shipment of potash from Utah fields.

Salt Lake County

UNITED STATES SMELTING (Midvale)—Recent additions having been completed, work was resumed Oct. 20 at concentrator.

UTAH METAL AND TUNNEL (Bingham)—Arrangements are being made to buy the Bingham-New Haven company's property, which adjoins the Utah Metal on the south and west.

ALBION (Alta)—Work was resumed Oct. 23 in neighborhood of caved ground. As soon as timbering is completed, raise can be started on ore. To date three cars of ore have been shipped by leasers.

ALTA RAILWAY TRANSPORTATION CO. (Salt Lake)—Men are at work clearing out right of way between Wasatch and Tanner's Flat, 3 mi. above. It is intended to put in track, 24-in. gage, and to deliver ore from Tanner's Flat to Salt Lake & Alta R.R. terminus at Wasatch for $1 a ton.

UTAH COPPER (Bingham)—The production for September amounted to 14,159,289 lb., as compared with 15,966,543 lb. in August. Company has purchased for $5,000 Ohio Copper ground, including right-of-way. Purchase was made some time ago, but only recorded Nov. 4.

SOUTH HECLA (Alta)—The lease on the Kate Hayes fissure is shipping 40 tons every other day, and 40 tons daily is being sent out by the company from the Wedge workings. The latter ore brings $30 to $40 net smelter returns. On the 250 level the large vein has been followed over 200 ft. and has been crosscut at several points. It varies from 20 ft. in width to 60 ft. at one point.

UTAH IRON AND STEEL (Midvale)—This company filed articles of incorporation Oct. 22; capitalization is $300,000, in shares of $100 each. Purpose of company as stated is to manufacture iron, steel, manganese, coke, copper, etc.; also to build bridges, machinery, and generally to engage in the manufacture of iron and steel structures. C. W. Whitley is president; N. Rosenblat, S. A. Whitney, S. Rosenblat, W. S. McCornick, L. Green, and M. Rosenblat are directors.

Summit County

DALY-JUDGE (Park City)—Development work on 1,100 level has opened full face of silver-lead ore of shipping grade. Most of ore from deeper levels has heretofore been of milling grade.

DALY WEST (Park City)—On account of the water-supply running a little low this fall, the mill has not been operating full time. Development and mining continue, however, and a considerable output of direct shipping ore is being made. Water shortage will be relieved by the first snows.

Weber County

PROMONTORY BAY MINING (Ogden)—Articles of incorporation have been filed by this company to develop zinc and lead property on Promontory Point, 30 mi. west of Ogden. Capitalization is $50,000, par value of stock being 10c. a share. D. J. Sheehan is president. Other companies recently incorporated in the district are: Lake View Mining, Little Valley Mining, Grand View, Indianola, Midlake, and Promontory Zinc.

WISCONSIN

Zinc-Lead District

OPTIMO (Linden)—Company has started construction of a new concentrating mill.

MINERAL POINT ZINC CO. (Mineral Point)—A big deposit of carbonate ore has been proved by churn drilling on the Kennedy land at Highland.

QUINCY (Platteville)—A. L. Utt and others have leased this tract, three miles southwest of Platteville; property is partly prospected by drill and shaft.

BELOIT-ELMO (Platteville)—J. M. Edwards, representing Michigan copper interests, has taken over this property, four miles south of Platteville, and has begun prospecting work.

CANADA

Ontario

TOUGH OAKES (Kirkland Lake)—An initial dividend of 2½% has been declared.

BEAVER CONSOLIDATED (Cobalt)—This company has purchased group of 10 claims, comprising 360 acres, belonging to Kirkland Lake Gold Mines, Ltd.

SMITH-LABINE (Sesekinika)—Representative of the United States Smelting, Refining and Mining Co. is sampling this property on which company has secured an option.

ORILLIA MOLYBDENITE CO. (Orillia)—An initial shipment of two tons of molybdenite concentrate has been made to the British War Office. Weekly shipments will be made.

CANADIAN COPPER CO. (Sudbury)—This company has taken over from Smith & Durkee, of Sudbury, the option on a copper location in Connaught Township, east of the West Shining Tree district.

HOLLINGER (Timmins)—For four weeks ended Oct. 7, gross profits were $158,342 from 27,029 tons of ore, average value of $9.66 per ton, the working costs being $3.19 per ton milled. The mill also treated 10,990 tons of ore from the Acme mine.

FOSTER & COFFIN (Sarnia Township)—This American firm has secured extensive leases of oil properties relinquished eight years ago by the Imperial Oil Co. It has cleaned out and shot two wells, now yielding total of 15 bbl. daily, and drilled one new well which started with a flow of 25 bbl. Contracts let for 10 more wells.

SOUTH AMERICA

Chile

BRADEN (Rancagua)—October production amounted to 1,863 tons of copper—a record output except for the extraordinary production of August, 1915.

ASIA

Chosen

ORIENTAL CONS. (Unsan District)—Tonnage milled during September aggregated 25,472 tons. Extraction obtained in Taracol cyanide plant was unusually high, 95.7%. Extraction obtained in the Maibong tube-mill plant was also high, 98.1%, but as extraction for August was low, average extraction for August and September in this plant is approximately 88%. Candlestick mill and cyanide plant ran 13 days 15 hr. during September and were then closed down. Cannot operate Candlestick mine at a profit owing to decrease in contents and width of orebody. Intends to lease mine to Korean tributors. Total bullion output for September as follows: Tabowie mill, $26,935; Taracol mill, $18,914; Maibong mill, $25,783; Candlestick mill, $3,341; Taracol cyanide plant, $50,627; Maibong tube mill, $5,317; Candlestick cyanide plant, $772; total, $131,693.

The Market Report

Metal Markets

NEW YORK—Nov. 10

All of the principal markets were strong and active during the last week, and in each case there was an advance in price.

Copper, Tin, Lead and Zinc

Copper—A rather large business was done during the week, about equally divided between domestic and foreign buyers. It is a noteworthy feature that domestic buyers now appear to be in the market right along instead of buying large quantities all together and then staying away for a long time, which seemed to be their policy a little while ago. On Nov. 6 there was a strike at the Nichols refinery and up to the time of our going to press the plant was still shut down entirely. The deprivation of the large output from this source combined with the well sold position of producers anyhow tended to create some apprehension respecting the supply of near-by copper, and metal for that delivery was readily sold at 18¼c., regular terms. Copper for December and January shipment was sold down to 18c., there being considerable competition among some sellers who were able to contract at relatively low prices for Chile bars and other raw material and sell electrolytic against it at a profit.

In the London market electrolytic copper was offered by American producers from £89 at the opening to £90½ toward the end of the week, but they had to meet the competition of Australian and other producers who took some desirable business at lower prices expressed in sterling, not being troubled either by the high exchange rate or the high freight rate that confront American producers. The freight, insurance and other costs in delivering copper from America to London at the present time amount to 0.75@1c. per pound.

Copper Sheets base price is now 23¼c. per lb. for hot rolled and 24¼c. for cold rolled.

Copper Exports week ended Oct. 23, as reported by Department of Commerce, were 15,229,219 lb.: the chief items being 5,341,186 lb. to France, 4,356,064 lb. to Italy, 3,198,949 lb. to England and 1,680,857 lb. to Russia. Copper imports were 1,652,307 lb. metal and 762,018 lb. in ore and matte; 2,414,325 lb. in all. The larger imports were from Canada, Cuba, Newfoundland and Japan.

Visible Stocks of Copper in Europe on Oct. 31 were: Great Britain, 18,410; France, 1,925; afloat from Chile, 1,050; afloat from Australia, 3,500; total, 24,885 long tons, being 1,068 tons more than Oct. 15, but 4,098 tons less than the Sept. 30 report.

Tin—A good business was done right through the week and the price rose further under the influence of the buying.

Visible Stocks of Tin Oct. 31, including tin afloat, were: London, 5,152; Holland, 315; United States, excluding Pacific ports, 7,687; total, 13,154 long tons, being 2,037 tons less than on Sept. 30, but 2,260 tons more than on Oct. 31 last year.

Bolivian Exports of Tin concentrates and bars from West Coast ports, seven months ended July 31, were 20,001 tons, equal to 12,355 long tons fine tin. Adding cable reports for August and September makes the total for the nine months ended Sept. 30 equal to 16,240 tons fine tin. The shipments to New York for the seven months were 499 tons, equal to 318 tons fine tin.

Lead—On Nov. 4 the American Smelting and Refining Co. raised its price to 5c., this following some large and satisfactory selling from that quarter which made it appear likely that the higher price could be obtained. This proved to be the case, a pretty good business on the 5c. basis being done by all of the principal producers. During the morning of Nov. 10 the American Smelting and Refining Co. made a further advance, this time to 5.15c. The St. Louis market held during the week at about 7½ to 10 points under the New York price. Sales of special brands of Missouri lead were made at as much as 10 points premium. The kind of lead that used to be known as "Chemical hard" is especially in demand, owing, no doubt, to the large requirement of it for building sulphuric-acid chambers.

Spelter—A further large business was done, and this week, for the first time in many, domestic consumers figured in the market, certain prominent galvanizers being large buyers, both for delivery in this quarter and next. Some export business also was done. The natural consequence of the large buying was to advance the price further. The transactions covered a wide range of prices and deliveries. There was a good deal of business done for November-December shipment, and a good deal for shipment in the first quarter of 1916, while some sales running ahead to next June were made.

Zinc Sheets were advanced on Nov. 4, making the base price $16.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Nov. 9 the price was advanced to $17 per 100 lb., with usual discount.

DAILY PRICES OF METALS IN NEW YORK

Nov.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
4	4.6388	50	17.70 @17.90	36½	4.90 @5.00	4.80 @4.90	13.50 @15.00
5	4.6475	50	17.70 @17.90	36½	4.90 5.00	4.90 @4.92½	13.50 @15.00
6	4.6475	49⅞	17.80 @18.00	36½	4.90 5.00	4.90 @4.92½	13.75 @15.25
8	4.6475	50⅛	17.80 @18.05	36	4.90 5.00	4.90 @4.92½	14.00 @15.50
9	4.6450	50⅛	17.80 @18.05	36⅛	4.90 5.00	4.90 @4.92½	14.00 @15.50
10	4.6475	50	17.80 @18.05	36¼	5.15	5.07½	14.25 @15.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Nov.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
4	24 7/16	74	74½	88½	18.26	163½	162¾	24 5/16	5.02	77	15.89
5	24⅜	74	74⅜	89½	18.52	162	161⅛	24⅜	5.13	77	15.93
6	24 5/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	24 7/16	73¼	73⅜	90	18.62	162	161⅛	24⅜	5.10	78½	16.24
9	24 7/16	74⅛	74⅜	90½	18.72	162¾	162¾	24⅜	5.12	78½	16.23
10	24⅜	74⅜	75⅛	90½	18.73	164½	164	24⅜	5.13	78½	16.24

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Other Metals

Aluminum—Market conditions are unchanged. Spot metal is firmly held, 55@58c. being quoted for No. 1 ingots, New York. No quotations on futures.

The reported sale of the property of the Southern Aluminium Co. to the Aluminum Co. of America is confirmed. It is announced that the purchaser will go on and complete the plant, carrying out the original plans with only slight changes.

Antimony—The market is quieter and business has been on a moderate scale, with no material change in prices. Ordinary brands, chiefly Chinese, sold at 36½c. per lb.; while 45c. per lb. is asked for Cookson's.

A United States consular report from Japan says that the large advance in the price of antimony has acted as a great impetus to antimony mining in that country, and the mines at Ichinogawa, Fujinogawa, and Tatsugawa have all been considerably extended; yet their present output aggregates only about 50 tons a month. This quantity is only a fraction of the monthly consumption in Japan.

Nickel.—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

The International Nickel Co., under date of Nov. 1 announces a base price of 31c. per lb. for Monel metal hot rolled rods. Extras are charged for hexagons and other shapes, for small quantities, etc. Price is f.o.b. works, Bayonne, N. J. Scrap allowance 18c. per lb. delivered to works.

Quicksilver—The market is strong and prices have advanced, the stocks being very light. New York quotation is $100 per flask of 75 lb. for large lots; while $105 up to $110 has been paid for smaller orders. San Francisco reports by telegraph a market strong at $98 per flask, with light stocks. London price is £16 per flask, with same quotation from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure, is sold at $1 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.—**Tellurium** is quoted at 80s. per lb. in London.

Gold, Silver and Platinum

NEW YORK—Nov. 10

Gold in the United States Nov. 1 as estimated by the Treasury Department: In Treasury against gold certificates outstanding, $1,375,392,789; in Treasury current balances, $216,809,613; in banks and circulation, $605,911,360; total, $2,198,113,762. This is an increase of $56,331,503 during October.

Gold Sales from United States Assay Office in New York in October were $3,452,764, being $432,045 more than in September. For the 10 months ended Oct. 31 the total sales were $55,751,523 in 1914, and $27,892,701 in 1915; a decrease of $27,858,822 this year.

One shipment of gold to Europe is on record this week, $500,000 having been sent to Amsterdam by a New York branch of a Dutch house.

Platinum—The market is quiet, sales being limited by the absence of supplies and the uncertainty of obtaining more. Prices are uncertain and subject generally to negotiation. Quotations are rather nominal at $52@56 per oz. for refined platinum; $56@60 per oz. for hard metal.

Our Russian correspondent writes under date of Oct. 11 that a new sharp advance of the prices is to be noted, due to the great demand for platinum for the internal market. The consumption of platinum has greatly increased, owing to the erection of new sulphuric acid works for war purposes. Many poods have been sold in Petrograd at high prices. The metal is quoted in Petrograd at 46,000@47,000 rubles per pood; at Ekoterinburg, 11@11.25 rubles per zolotnik, for crude metal, 83% platinum. These prices are equivalent to $45.57 and $41.83 per oz. average.

Silver—Our latest advices are to the effect that there has been some substantial buying for the East, and that the low rates of exchange on London have had a hardening effect on the silver market, so that the undertone seems good, with a reasonable probability that the present level may be maintained, subject of course to some fluctuations.

Coined silver in the United States Nov. 1 is estimated by the Treasury Department as follows: Standard dollars, $578,271,655; subsidiary coins, $186,730,386; total, $765,002,041. Of the silver dollars $486,851,787 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

PLATTSVILLE, WIS.—Nov. 6

The base price paid this week for zinc ore was $80@85 per ton for 60% grades. The base price paid for 80% lead ore was $56 per ton.

SHIPMENTS, WEEK ENDED NOV. 6

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,717,300	144,200	347,,860
Year	174,033,350	6,028,540	23,072,590

Shipped during week to separating plants, 5,354,000 lb. zinc ore.

JOPLIN, MO.—Nov. 6

Blende, high price $102.50; base per ton 60% zinc, premium ore, $100; medium, $98@90; lower grades down to $85; calamine, base per ton of 40% zinc, $60@70; average selling price, all grades of zinc, $90.28 per ton. Lead, high price $61.10; base per ton 80% metal contents, $54@60; average selling price all grades of lead, $54.82 per ton.

SHIPMENTS WEEK ENDED NOV. 6

	Blende	Calamine	Lead	Values
Totals this week..	12,893,330	724,820	2,127,050	$673,020
Totals this year..	492,174,350	36,708,990	76,723,020	21,851,590

Blende value, the week, $591,840; 45 weeks, $18,980,250.

Calamine value, the week, $22,880; 45 weeks, $859,740.

Lead value, the week, $58,300; 45 weeks, $2,011,600.

No end of excitement was thrust into the market for both zinc and lead. Advances of $10 per ton were the order all along the line in zinc, and lead also was advanced $10 per ton by the Picher Lead Co. which has declined to compete with other buyers at a price over $50 base until this week. The heavy shipment of this week shows the strong buying tendency at the close of last week, and just how heavy this week-end buying will prove cannot be estimated from the various reports current.

Iron Trade Review

NEW YORK—Nov. 10

The year which opened lamely and uncertainly is drawing to its end with a rush. October production and November active furnace capacity are about double the production in January. Export and domestic business are crowding the mills and making postponement of deliveries the rule. Some premiums for early deliveries are reported.

Pig iron is active, with large buying of basic metal, and a rapidly improving demand for foundry iron. The long expected buying movement has set in.

Pig Iron Production again increased in October. The reports of the blast furnaces, as collected and published by the "Iron Age" show that on Nov. 1 there were 276 coke and anthracite furnaces in blast, with a total daily capacity of 101,800 tons, an increase of 4,865 tons over Oct. 1. Making allowances for the charcoal furnaces the total production of pig iron in the United States in October was 3,159,500 long tons; for the 10 months ended Oct. 31 it was 23,668,000 tons. Of this total 17,354,031 tons, or 73.3%, were made by the furnaces owned or operated by steel companies.

Exports and Imports of Iron and Steel—including machinery—in the United States eight months ended Aug. 31 are valued as below by the Department of Commerce:

	1914.	1915.	Changes.
Exports	$140,245,736	$212,697,467	I$72,451,731
Imports	20,745,326	13,451,040	D 7,294,286
Excess, exports...	$119,500,410	$199,246,427	I$79,746,017

The increase in exports has been all in the later months of the year. The August exports were $37,726,822 in 1915, against $10,428,817 last year.

PITTSBURGH—Nov. 9

Movements in the iron and steel market have passed beyond all the bounds indicated by precedent. There are no longer any guesses for the future. The demand for steel is simply overwhelming. There is very little contracting being done for finished steel products, the mills being offered more business, in the form of specific orders, than they can well handle. Conditions may, of course, be easier after the first of the year when many quarterly or half-yearly contracts will have expired, but as no steel seems to be going into stocks it is doubtful whether there will be any noticeable relief. The whole course of the steel market is changing in that specific orders are the rule rather than contracts.

The war demand has broadened. Several very large inquiries have appeared for sheets for war purposes, while the demand for shell steel is heavier than ever, and long term deliveries are asked. The domestic demand has increased sharply, and particularly in railroad quarters. Estimates are made

that as many as 100,000 freight cars may be ordered within the next few weeks.

Last Thursday bars, plates and shapes advanced from 1.50 to 1.60c., through the announcement made by the Carnegie Steel Co. on that day, and it is thought possible the next advance, in the near future, will be to 1.75c., although the market was steady 30 days ago at 1.40c. Sheets are advancing sharply, with many mills practically out of the market. The few first-quarter contracts accepted are at 2.25@2.35c. for black.

Pig Iron—Following the heavy sales of bessemer and basic iron reported a week ago the market has been widely excited. Furnaces advance their asking price sharply and do not care whether or not orders come. Yesterday a sale of 2,000 tons of bessemer pig iron was made for November-December delivery to a domestic consumer at $17.50, Valley, or $1 a ton above the market quotable a few days ago and $1.50 above the market a week ago. Basic iron, which advanced from $15 to $15.50 on the last day of last month, might not be had today at $16. Foundry iron has been rather quiet but will undoubtedly advance sharply on the appearance of any buying movement. The producers are quite indifferent. We quote the market at not under the following: Bessemer, $17.50; basic, $16@16.50; foundry and malleable, $15.50@16; forge, $15@15.50, fo.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market is altogether dislocated by the heavy demand for war billets and for ordinary forging billets, a demand that has caused some sheet mills with attendant open-hearth steel furnaces to close their sheet mills or use purchased bessemer sheet bars in order to make forging billets. A mill that recently sold openhearth sheet bars for first-half delivery is now trying to buy to fill the order, and make high carbon billets. Prices are higher but are not closely quotable, being approximately as follows: Bessemer billets, $25.50@26.50; bessemer sheet bars, $26@27; openhearth billets, $26,50@27.50; openhearth sheet bars, $27@28; forging billets, $42@45, f.o.b. maker's mill, Pittsburgh or Youngstown.

Ferromanganese—Demand has increased for both foreign and domestic on contract, the former being $100 and the latter $110@115, at shipping point. Prompt lots command intermediate prices.

FERRO-ALLOYS

Ferromanganese is still quoted at $100 Baltimore for imported; $110@115 for domestic, early delivery.—**Ferrosilicon** is higher; bessemer 10% is quoted $21.50 at furnace for spot, $21.50 for first quarter and $22 for second quarter. For 15@16%, higher prices, up to $31 at furnace are charged. High grade ferrosilicon, 50%, is quoted $85@87.50 per ton at Pittsburgh.—**Spiegeleisen** is active, with sales at $28@30 per ton at furnace.—**Ferrotitanium** is 8@12.5c. per lb., according to size of order and delivery.—**Ferrovanadium** $2@2.25 per lb. of contained vanadium.

FOREIGN IRON

German steel production in August was 1,157,651 metric tons, being 19,041 tons more than in July. For the eight months ended Aug. 21 the total make was, in metric tons:

	Basic	Acid	Total
Converter	4,248,243	104,202	4,352,445
Open hearth	3,407,799	158,027	3,565,826
Direct castings	283,817	99,104	382,921
Crucible	.....	66,985	66,985
Electric	.....	74,607	74,607
Total	7,939,859	502,925	8,442,784
Total, 1914	11,094,639	469,623	11,564,262

At the close of August there were 221 steel furnaces in operation and reporting production.

The British Blast Furnace report shows that 287 stacks were active in the quarter ended Sept. 30, against 294 in the June quarter and 281 in the September quarter last year.

IRON ORE

Lake Superior iron ore shipments in October were 7,146,875 tons. For the season to Nov. 1 shipments by ports were, in long tons:

Port.	1914	1915	Changes
Escanaba	3,440,992	4,940,081	I. 1,499,089
Marquette	1,651,579	2,836,203	I. 1,184,624
Ashland	3,229,746	4,695,752	I. 1,466,006
Superior	10,920,469	7,348,916	D. 3,571,553
Duluth	6,197,043	14,108,571	I. 7,911,528
Two Harbors	5,511,976	7,886,916	I. 2,374,940
Total	30,951,805	41,816,439	I. 10,864,634

The total sales of iron ore reported for the season, with only a few mines estimated, were 46,667,796 tons. This would leave about 4,850,000 tons to be moved.

Imports and exports of iron ore in the United States eight months ended Aug. 31, long tons:

	1914	1915	Changes
Imports	985,796	797,845	D. 187,951
Exports	518,597	370,965	D. 147,632

The principal imports were 501,588 tons from Cuba, 147,694 tons from Sweden and 32,946 tons from Spain.

Imports of manganese ore for the eight months were 183,029 tons in 1914, and 145,003 in 1915; decrease, 38,026 tons.

OTHER ORES

Molybdenite, 90% MoS_2 is quoted in London at 120s.—$28.80—per unit. The Australian government takes all the ore produced in that country at 105s. per unit.—**Tungsten Ore** remains high, London quotations for wolframite, 65% WO_3, being 55s.—$13.20—per unit. Tungsten ore at New York is quoted at about $38 per unit for ore 60% or over in tungstic acid.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 432,519 short tons; shipments, 441,911 tons. Shipments of Greensburg and upper Connellsville districts, 41,700 tons.

Anthracite shipments in October were 6,505,892 long tons. For the 10 months ended Oct. 31 the shipments were 56,712,087 tons in 1914, and 53,885,003 in 1915; a decrease of 2,827,084 tons, or 5%, this year.

Foreign Fuel Trade of the United States eight months ended Aug 31, as reported by the Department of Commerce, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	2,666,969	2,304,964	15,902	2,390
Bituminous	9,045,260	10,588,583	861,513	951,517
Coke	456,661	513,679	67,003	33,620
Bunker coal	5,038,576	5,027,027	.....	.....
Total	17,207,466	18,434,253	944,418	987,527

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The increase this year in bituminous exports was to Italy and to South American countries.

Chemicals

NEW YORK—Nov. 6

The general market has shown some activity and generally a stronger tendency.

Arsenic—Business has been fair, and the market is generally steady. Quotations are $3.75@4 per 100 lb., according to size of order.

Copper Sulphate—Business has been steady, with no material change. Current prices are $6.50 per 100 lb. for carload lots and $6.75 for smaller parcels.

Nitrate of Soda—Demand is improving, though imports have been large. Prices are firmer, quotations being $2.90 per 100 lb. for spot and $2.85 per 100 lb. for futures.

Pyrites—Imports at Baltimore for the week included 5,022 tons pyrites from Huelva, Spain.

Imports and Exports of Chemicals in the United States eight months ended Aug. 31, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	2,861,891	2,422,514	700	8,825
Bleach	27,004,166	6,447,027	12,654	120,126
Acetate of lime	.....	.....	39,946,187	15,600,640
Calcium carbide	.....	.....	23,174,699	26,875,126
Potash salts	24,732,745	13,927,473	459,302	975,840
Sodium cyanide	218,392	3,640,488	.....	1,760,387
Soda salts, value	$436,705	$320,952	$8,116	$22,375

Exports include reëxports of foreign material. This statement does not include nitrate of soda nor crude potash salts used chiefly as fertilizers.

PETROLEUM

The monthly statement of "Oil City Derrick" gives the number of new wells completed in October as follows: Pennsylvania grade, 417; Lima-Indiana, 36; Central Ohio, 75; Kentucky, 11; Illinois, 79; Mid-Continent, 576; Texas-Louisiana, 114. The total number of wells completed was 1,308, the total production being 146,291 bbl. There were 249 dry holes and 165 gas wells reported. At the close of the month 2,327 wells were under the drill.

Exports of mineral oils from the United States in September are reported by the Department of Commerce at 214,743,373 gal. For the nine months ended Sept. 30 the total exports were 1,695,583,269 gal. in 1914, and 1,733,628,143 gal. in 1915; an increase of 38,044,874 gal., or 2.2%, this year.

Assessments

Company	Delinqe	Sale	Amt.
Aetna, Ida.	Oct. 16	Nov. 15	0.001
Argenta, Ida.	Oct. 11	Nov. 13	0.001
Blue Bull Reorg., Nev.	Nov. 1	Dec. 6	0.01
Coeur d'Alene Inv., Ida.	Oct. 25	Dec. 6	0.002
Copper Mt. M. & D., Ida.	Oct. 28	Dec. 1	0.002
Danley-Lloyd, Utah.	Nov. 14	Nov. 30	0.0025
Eagle Mt., Ida.	Oct. 15	Nov. 15	0.0005
Eastern Star, Ida.	Oct. 29	Nov. 29	0.002
Enterprise, Ida.	Oct. 15	Nov. 15	0.002
Great Western, Nev.	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich.	Jan. 3	.....	1.00
Hector, Ida.	Nov. 18	Dec. 10	0.005
Idaho & Los Angeles, Ida.	Nov. 26	Dec. 27	0.005
Idaho-Nevada Exp., Ida.	Nov. 1	Dec. 1	0.002
Ivanhoe, Ida.	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida.	Nov. 20	Dec. 20	0.01
Lewis & Clark, Ida.	Oct. 15	Nov. 15	0.001
Lucky Swede, Ida.	Nov. 11	Dec. 11	0.002
Military M. & M., Ida.	Oct. 28	Nov. 29	0.0065
Missoula Copper, Ida.	Nov. 15	Dec. 15	0.002
Montana Standard.	Nov. 15	Dec. 15	0.005
Nabob, Ida.	Oct. 25	Nov. 15	0.005
National Copper, Ida.	Nov. 20	Dec. 18	0.01
National Lead, Ida.	Nov. 15	Dec. 15	0.001
New Arcadian, Mich.	Dec. 1	.....	0.50
New Baltic, Mich.	Jan. 15	.....	0.50
Northern Light, Ida.	Nov. 2	Dec. 2	0.004
O. K. Ex. M. & R., Utah.	Nov. 20	Dec. 15	0.005
Old Vetearn, Ida.	Nov. 1	Nov. 27	0.002
Oom Paul Con., Ida.	Nov. 16	Dec. 6	0.01
Oriental, Nev.	Nov. 6	Dec. 7	0.003
Original, Nev.	Nov. 6	Dec. 7	0.003
Pacific M. & M., Ida.	Nov. 10	Nov. 30	0.0005
Phedora, Ida. (post.)	.....	Nov. 20	0.0005
Phoenix, Mich.	Jan. 1	.....	1.00
Pioche Metals, Nev.	Oct. 20	Nov. 20	0.00½
Rainbow, Ida.	Oct. 15	Nov. 20	0.002
Silver Cliff, Ida.	Nov. 8	Dec. 6	0.0025
Silver Moon, Ida.	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev.	Oct. 16	Nov. 23	0.01
Sonora M. & M., Ida.	Nov. 4	Dec. 17	0.003
Sunset M. & D., Nev.	Oct. 18	Nov. 22	0.02
Sunshine, Ida.	Oct. 15	Nov. 15	0.0006
Ton. Gipsy Queen, Nev.	Oct. 29	Dec. 6	0.01
Umatilla Ton., Nev.	Nov. 8	Dec. 13	0.005
Union Cons., Nev.	Oct. 25	Nov. 15	0.05
Wisconsin, Ida.	Oct. 19	Nov. 19	0.003
Wolf Mountain, Utah.	Nov. 12	Dec. 14	0.0025

Stock Quotations

The week has been marked by persistent and apparently causeless selling of the "war stocks," accompanied by severe declines. So far it appears simply to be a sharp manipulative attack.

COLO. SPRINGS Nov. 9		SALT LAKE Nov. 9	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia.	.02½	Beck Tunnel.	.04½
Cripple Cr'k Con.	.006	Black Jack.	.05
C. K. & N.	‡.02	Colorado Mining.	.05
Doctor Jack Pot.	.09½	Crown Point.	.01½
Elkton Con.	.29½	Daly-Judge.	6.90
El Paso.	.77	Emma Cop.	.26
Findlay.	.01½	Gold Chain.	.11
Gold Dollar.	.02½	Grand Central.	.50
Gold Sovereign.	.05½	Iron Blossom.	.80
Golden Cycle.	1.79½	Lower Mammoth.	.05
Isabella.	.17	May Day.	.20½
Jack Pot.	.06½	Opohongo.	.00½
Jerry Johnson.	.06	Prince Con.	.77
Lexington.	‡.005	Seven Troughs.	.01½
Mary McKinney.	.44	Silver King Coal'n.	3.00
Pharmacist.	‡.008	Silver King Con.	1.02½
Portland.	1.70	Sioux Con.	.02
Raven B. H.	.03½	Uncle Sam.	.07
Vindicator	1.63½	Yankee.	.35

TORONTO Nov. 9			
Bailey.	‡.04½	Dome Exten.	‡.27
Chambers Ferland.	‡.13½	Dome Mines.	24.25
Coniagas.	3.75	Foley O'Brien.	‡.48
Peterson Lake.	.22	Hollinger.	25.25
Right of Way.	‡.04	Imperial.	‡.05½
Seneca Superior.	‡.78	Jupiter.	‡.11½
Silver Queen.	‡.01	McIntyre.	.56
T. & Hudson Bay.	20.00	Pearl Lake.	‡.00½
Timiskaming.	.40	Porcu. Crown.	‡.80
Trethewey.	‡.14	Preston E. D.	‡.06
Wettlaufer-Lor.	‡.08	Rea.	‡.09

SAN FRANCISCO Nov. 9			
Alta.	.05	Belmont.	3.65
Andes.	.09	Jim Butler.	.79
Best & Belcher.	.05	Lone Star.	.04
Caledonia.	.98	MacNamara.	.02
Challenge Con.	.07	Midway.	.12
Chollar.	.03	Mont.-Tonopah.	.26
Confidence.	.20	North Star.	11.00
Con. Virginia.	.16	Rescue Eula.	.06
Gould & Curry.	.04	West End Con.	.62
Hale & Norcross.	.03	Atlanta.	.24
Jacket-Cr. Pt.	.17	Blue Bell.	.02
Julia.	.01	Booth.	.36
Mexican.	.34	C.O.D. Con.	.04
Occidental.	.78	Comb. Frac.	.08
Ophir.	.27	D'field Daisy.	‡.03
Overman.	.10	Jumbo Extension.	1.20
Potosi.	.02	Pitts.-Silver Peak.	.06
Savage.	.07	Round Mountain.	.42
Sierra Nevada.	.57	Sandstorm Kendall.	.09
Union Con.	.62	Silver Pick.	.07
Utah Con.	.04	Central Eureka.	.10

N. Y. EXCH. Nov. 9		BOSTON EXCH Nov. 9	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Juneau.	12½	Adventure.	2
Am.Sm.&Ref.,com.	91½	Ahmeek.	393
Am. Sm. & Ref., pf.	110½	Alaska Gold M.	30½
Am. Sm. Sec., pf. A	86½	Algomah.	1½
Am. Sm. Sec., pf. B.	83½	Allouez.	55½
Anaconda.	83	Am. Zinc	65½
Batopilas Min.	1½	Ariz. Com., ctfs.	7¾
Bethlehem Steel.	410	Bonanza.	.40
Bethlehem Steel, pf.	162	Butte-Ballaklava.	3½
Chino.	52	Butte & Superior.	65
Colo. Fuel & Iron.	49½	Calumet & Ariz.	66
Crucible Steel.	73½	Calumet & Hecla.	555
Federal M. & S., pf.	50	Centennial.	17
Great Nor., ore., ctf.	47½	Copper Range.	58½
Greene Cananea.	39½	Daly West.	2½
Guggen. Exp.	70½	East Butte.	14½
Homestake.	120	Franklin.	9½
Inspiration Con.	42	Granby.	83
International Nickel	186½	Hancock.	15½
Miami Copper.	33½	Hedley.	28
Nat'l Lead, com.	64½	Helvetia.	.50
National Lead, pf.	111½	Indiana.	5
Nev. Consol.	15½	Island Cr'k, com.	43½
Ontario Min.	3½	Island Cr'k, pfd.	87
Quicksilver.	4½	Isle Royale.	27½
Ray Con.	25½	Keweenaw.	2½
Republic I&S, com.	47½	Lake.	12½
Republic I&S, pf.	105	La Salle.	5½
SlossSheffl'd, com.	58½	Mason Valley.	1½
Tennessee Copper.	52½	Mass.	12½
Utah Copper.	72½	Mayflower.	4½
U. S. Steel, com.	84½	Michigan.	2½
U. S. Steel, pf.	115½	Mohawk.	82½
		New Arcadian.	10
N. Y. CURB Nov. 9		North Butte.	30½
Alta Con.	.14	North Lake.	1½
Beaver Con.	.30	Ojibway.	1½
Big Four.	.05	Old Colony.	3½
Braden Copper.	12½	Old Dominion.	56
Buffalo Mines.	.50	Osceola.	84
Can. Cop. Corpn.	2½	Quincy.	85½
Cashboy.	.06	Santa Fe.	3½
Cerrode Pasco.	35½	Shannon.	8
Chile Cop.	24½	Shattuck-Ariz.	31½
Con. Ariz. Sm.	1½	Superior.	27½
Con. Coppermines.	1½	Superior & Bost.	2½
Con. Nev.-Utah.	1/16	Tamarack.	55½
Dia. Black B.	.05	Trinity.	9½
Florence.	.42	Tuolumne.	.33
Goldfield Con.	1 1/16	U. S. Smelting.	43½
Goldfield Merger.	.18	U. S. Smelt'g, pf.	47
Howe Sound.	4	Utah Apex.	3½
Kennecott Cop.	48½	Utah Con.	12½
Kerr Lake.	3½	Victoria.	2½
La Rose.	½	Winona.	3
Magma.	14	Wolverine.	59
McKinley-Dar-Sa.	.30	Wyandot.	1½
Mines of Am.	2½		
Mother Lode.	.30	BOSTON CURB Nov. 9	
Nevada Hills.	.17	Bingham Mines.	7½
New Utah Bingham	3	Boston Ely.	.21
Nipissing Mines.	6½	Butte & Lon'n Dev.	.43
Oro.	.06½	Calaveras.	1½
St. Joseph Lead.	13½	Calumet-Corbin.	.02
South Utah.	.25	Chief Con.	.92
Stand'd Oil of N.J.	482	Cortez.	.50
Standard S. L.	1½	Crown Reserve.	.50
Stewart.	.75	Davis-Daly	1 1/16
Success.	.72	Eagle & Blue Bell.	1 1/16
Tonopah.	5½	First Nat. Cop.	4½
Tonopah Ex.	2½	Houghton Copper.	3
Tonopah Merger.	.38	Iron Cap Cop., pf.	6
Tribullion.	1 1/16	Majestic.	.66
Yukon Gold.	2½	Mexican Metals.	.30
		Nevada-Douglas.	.65
LONDON Oct. 28		New Baltic.	3½
Alaska Tre'dwell	£6 10s 0d	New Cornelia.	8½
Burma Corp.	1 8 9	Ohio Copper.	.15
Cam & Motor.	0 13 9	Oneco.	1
Camp Bird.	0 7 6	Raven Copper.	.10
El Oro.	0 10 6	Rex Cons.	.47
Esperanza.	0 11 3	Smokey Dev.	.15
Mexico Mines.	4 10 0	So. Lake.	5½
Nechi, pfd.	0 12 9	Tonopah Victor.	.30
Oroville.	0 14 0	United Verde Ext.	5½
Santa Gert'dis.	0 10 0	Utah Metal.	8½
Tomboy.	1 1 0		
Tough Oakes.	0 7 0	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January.	62.938	57.572	48.855	28.983	26.553	22.731
February.	61.642	57.506	48.477	28.357	26.573	22.753
March.	57.870	58.067	50.241	26.669	26.788	23.708
April.	59.490	58.519	50.250	27.416	26.958	23.709
May.	60.361	58.175	49.915	27.825	26.704	23.570
June.	58.990	56.471	49.034	27.199	25.948	23.267
July.	58.721	54.678	47.519	27.074	25.219	22.597
August.	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October.	60.793	50.654	49.385	28.083	23.199	23.925
November.	58.995	49.082	.....	27.263	22.703	.....
December.	57.760	49.375	.....	26.720	22.900	.....
Year.	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January.	14.223	13.641	64.304	60.756	69.488	65.719
February.	14.491	14.394	65.259	63.494	70.188	*
March.	14.131	14.787	64.276	66.152	69.170	*
April.	14.211	16.811	64.747	75.096	69.313	*
May.	13.996	18.506	63.182	77.600	67.786	*
June.	13.603	19.477	61.336	82.574	66.274	95.333
July.	13.223	18.796	60.540	76.011	64.955	91.409
August.	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October.	*	17.686	‡	72.601	‡	88.000
November.	11.739	.....	53.227	.....	*	.....
December.	12.801	.....	56.841	.....	*	.....
Year.	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January.	37.779	34.260	171.905	156.550
February.	39.830	37.415	181.556	176.925
March.	38.038	48.426	173.619	180.141
April.	36.154	47.884	163.963	166.225
May.	33.360	38.790	150.702	162.675
June.	30.577	40.288	138.321	167.636
July.	31.707	37.423	142.517	167.080
August.	*	34.389	‡	151.440
September.	32.675	33.125	‡	152.625
October.	30.284	33.080	‡	151.554
November.	33.304	.....	1 9.391	.....
December.	33.601	.....	147.102	.....
Av. year.	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	4.111	3.729	4.011	3.548	19.665	18.606
February.	4.048	3.827	3 937	3.718	19.606	19.122
March.	3.970	4.053	3.850	3.997	19.651	21.883
April.	3.810	4.221	3.688	4.142	18.225	21.094
May.	3.900	4.274	3.808	4.182	18.503	20.347
June.	3.900	5.932	3.810	5.836	19.411	25.170
July.	3.891	5.659	3.738	5.531	19.051	24.611
August.	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October.	3.528	4.600	3.384	4.499	‡	23.994
November.	3.683	.....	3.585	.....	18.500	.....
December.	3.800	.....	3.662	.....	19.097	.....
Year.	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	5.262	6.386	5.112	6.211	21.533	30.844
February.	5.377	8.436	5.228	8.255	21.413	39.819
March.	5.250	8.541	5.100	8.366	21.460	44.141
April.	5.113	10.012	4.963	9.837	21.569	49.888
May.	5.074	14.781	4.924	14.610	21.393	68.100
June.	5.000	21.208	4.850	21.038	21.345	100.614
July.	4.920	19.026	4.770	18.856	21.568	97.250
August.	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October.	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	.....	4.962	.....	25.016	.....
December.	5.592	.....	5.430	.....	27.369	.....
Year.	5.213	.....	5.06	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January.	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February.	15.06	14.55	14.12	13.45	14.08	13.90
March.	15 07	14.55	13.91	13.45	14.10	13.95
April.	14.90	14.55	13.90	13.45	14.13	13.95
May.	14.90	14.61	13.90	13.60	14.27	13.83
June.	14.90	14.70	13.90	13.67	13.96	13.77
July.	14.90	14.94	13.90	13.91	13.90	13.68
August.	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October.	14.84	16.95	13.75	15.96	13.97	15.80
November.	14.59	.....	13.43	.....	13.83	.....
December.	14.70	.....	13.45	.....	13.83	.....
Year.	$14.88	.....	$13.78	.....	$14.01	.....